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Trading Places: Measurement and Analysis in the Eyes of the Acquirer and the Supplier

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Objectives

Establish a view of the acquirer and supplier/contractor roles and responsibilities.

Show how measurement and analysis skills for internal development can be recast for acquisition and contracting environments.

Address two prevalent questions in the acquisition community:

- How can measurement be used to improve requirements-related processes?
- How can we conduct causal analysis when we no longer control the collection processes and/or data?

Outline

Context
- state of the community
- changing perspectives

Background
- roles & responsibilities
- maturity models
- measurement & analysis methods

Scenario
- goal-setting and success, progress, analysis indicators
- inspecting the quality of deliverables: requirements
- monitoring and oversight: progress analysis
- measurement in the contract
- communicating with integrated measures

Summary

Terms and Usage

We use the terms “acquisition” and “contracting” interchangeably throughout this tutorial.

In addition, the terms “contractor” and “supplier” are used interchangeably. The term “developer,” in the context of this tutorial, is used to describe a contractor.

Trends in Outsourcing [1]

From Gartner Group (2002)

- one out of every 10 jobs with U.S.-based information technology vendors and service providers will be exported
- more than 80 percent of corporate boards of directors will have considered offshore outsourcing
- 40 percent of corporations will have finished an outsourcing pilot program or be actively involved in outsourcing technology services

From Forrester Research

- offshore outsourcing will account for 28% of IT budgets in Europe and the U.S. by 2004
- offshore IT workers will go from 360,000 (in 2002) to more than 1 million in 2005

[www.rosourcing.com], [robb 02], [diana 03]

Trends in Outsourcing 2

From Michael F. Corbett & Associates:

- Offshore outsourcing is just one small part of a (US)$5 trillion global outsourcing market.
- This market is growing by more than 15 percent per year, and the offshore component is certainly among the fastest growing
- For U.S. IT professionals, this probably means that their future success will come from moving up the IT value chain

From Ovum research

- The outlook for the future is more offshore outsourcing, but not at the levels predicted by other analysts in this area

[www.rosourcing.com], [robb 02], [diana 03]

Why Do Organizations Outsource?

Top 10 Reasons from The Outsourcing Institute:

- Reduce and control operating costs
- Improve company focus
- Gain access to world-class capabilities
- Free internal resources for other purposes
- Resources are not available internally
- Accelerate reengineering benefits
- Function difficult to manage/out of control
- Make capital funds available
- Share risks
- Cash infusion

[www.rosourcing.com]

The Supplier Landscape 1

Contractor dimensions:

- geography
- style
- maturity
- processes

Examples include the following:

- domestic development groups
- offshore development groups
- dedicated offshore development centers
- off the shelf, COTS products
- systems integrators
- open source
- rational
- PSP/TSP

The Supplier Landscape 2

From Forester Research

- 88% of the firms looking overseas for services claim to get better value for their money off shore.
- 71% said offshore workers did better quality work.

[www.rosourcing.com]

Contracting Challenges 1

From *Software Magazine* in 2001:

- 23% of software projects are cancelled
- Cost growth averages 45%
- Schedule growth averages 67%
- Average final product will include only 67% of its requirements
- Only 28% of projects finish on schedule and within budget

Cited by a sampling of Army Acquisition Managers

- The majority of problems and risks affecting acquisition problems resides "somewhat" with the following:
  - factors outside the control of acquirers and developers
  - acquisition program policies and processes
  - contracting processes
  - the contractor's development process

[ASSIP 03], [SWM 01]

Contracting Challenges 2

Cited by a sampling of Army Acquisition Managers

- The top problem areas include
  - requirements management (selected by 63%)
  - project management (22%)
  - contractor processes (22%)
  - unstable funding (21%)

From a recent presentation on component technology

- contractor qualifications *(Mitigation: CMMI)*
- requirements definition *(Mitigation: close partnerships)*
- engineering acceptance *(Mitigation: process analysis)*

[ASSIP 03], [Scherlis 03]

Measurement Challenges

From interviews of several acquisition management personnel:

- "Measurement" is not a troublesome issue in itself; however, getting consistent, meaningful data and understanding how to use data is a high priority and concern.
- There is a tremendous need for progress measures that can be used for timely warning of major program disasters.

[C-M-H 03]

Measures in Practice 1

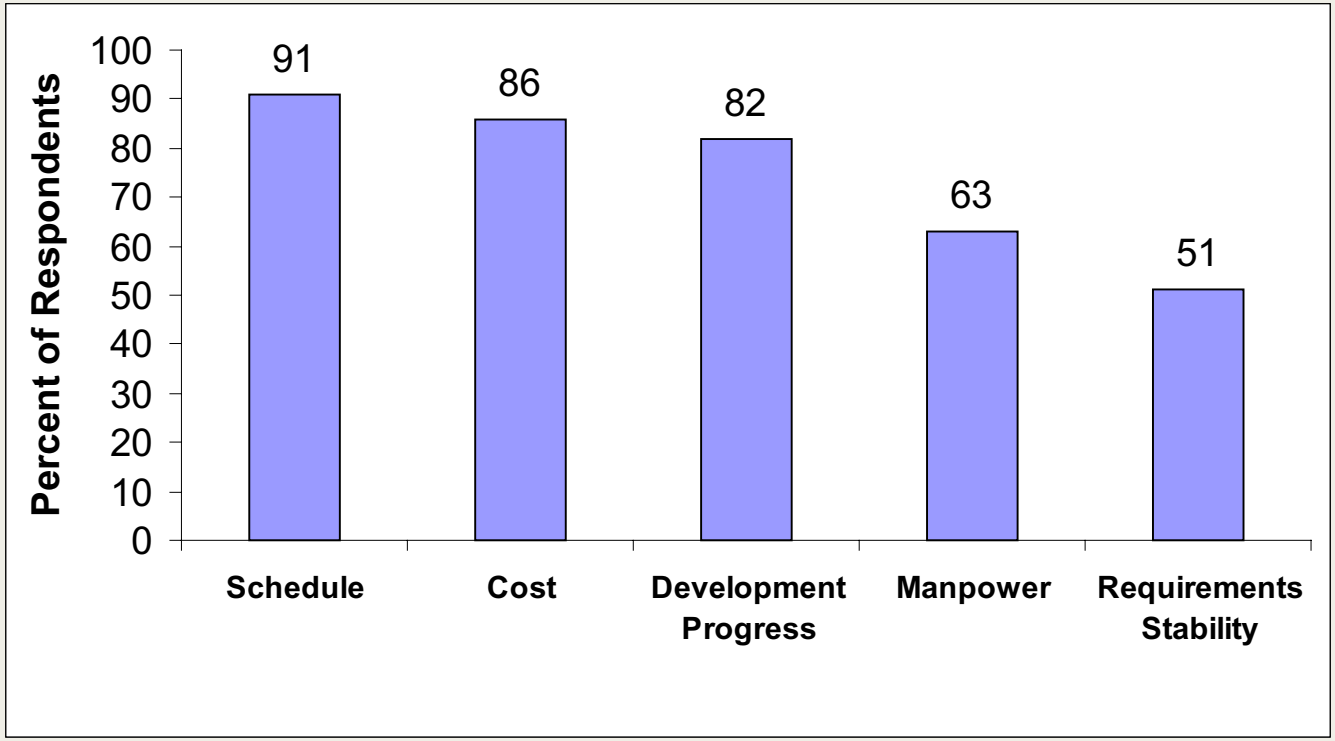
In a recent survey, a sampling of Army Acquisition Managers affirmed the following

- 83% based planning estimates on historical data
- 79% defined quantitative objectives for acquired products and services
- 81% used metrics as an input to decision making
- 75% measured and controlled project cost and schedule
- 50% recorded data in organizational measurement repository
- 78% had sufficient insight into the contractor's software engineering effort to ensure project is managed and controlled and complies with contract requirements
- 78% appraised the quality of the contractor's process, performance, products, and services throughout the contract to identify risks and take appropriate action

[ASSIP 03]

Measures in Practice 2

The surveyed Army Acquisition Managers use these measures to track project status:



[ASSIP 03]

What Does This Mean?

Issues in contracting are complex and multidimensional.

- Requirements management is a problem area that frequently is not well measured.
- Project monitoring and oversight is fairly well measured, but the related analysis may not be mastered.
- Organizations may often measure what they know how to measure, but not necessarily measure all that is needed to be successful.

How does this compare to your experience?

Outline

Context
- state of the community
- changing perspectives

Background
- roles & responsibilities
- maturity models
- measurement & analysis methods

Scenario
- goal-setting and success, progress, analysis indicators
- inspecting the quality of deliverables: requirements
- monitoring and oversight: progress analysis
- measurement in the contract
- communicating with integrated measures

Summary

Responsibility and Authority

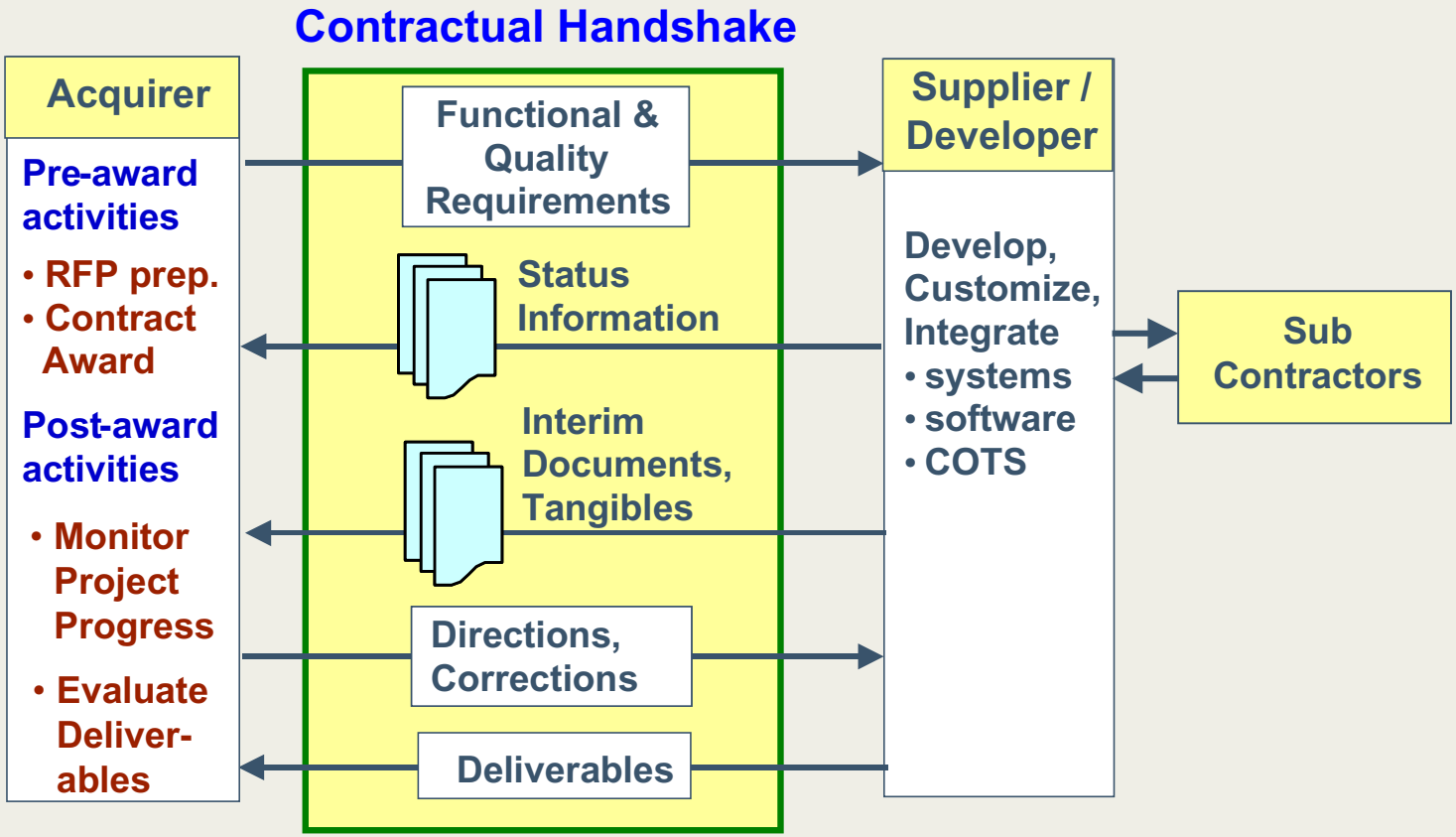
Measuring project and product success is the same whether the project is internal or contracted:

- on schedule
- at cost
- with required functionality
- without defects

The acquiring program manager's "circle of influence" and "circle of control" is different than the development project manager's.

- development project manager addresses the daily details of project execution
- acquisition program manager defines and executes a new set of processes
- acquisition program manager should leverage development knowledge to manage the contract methodically, rationally, and knowledgeably

Roles and Information Exchange



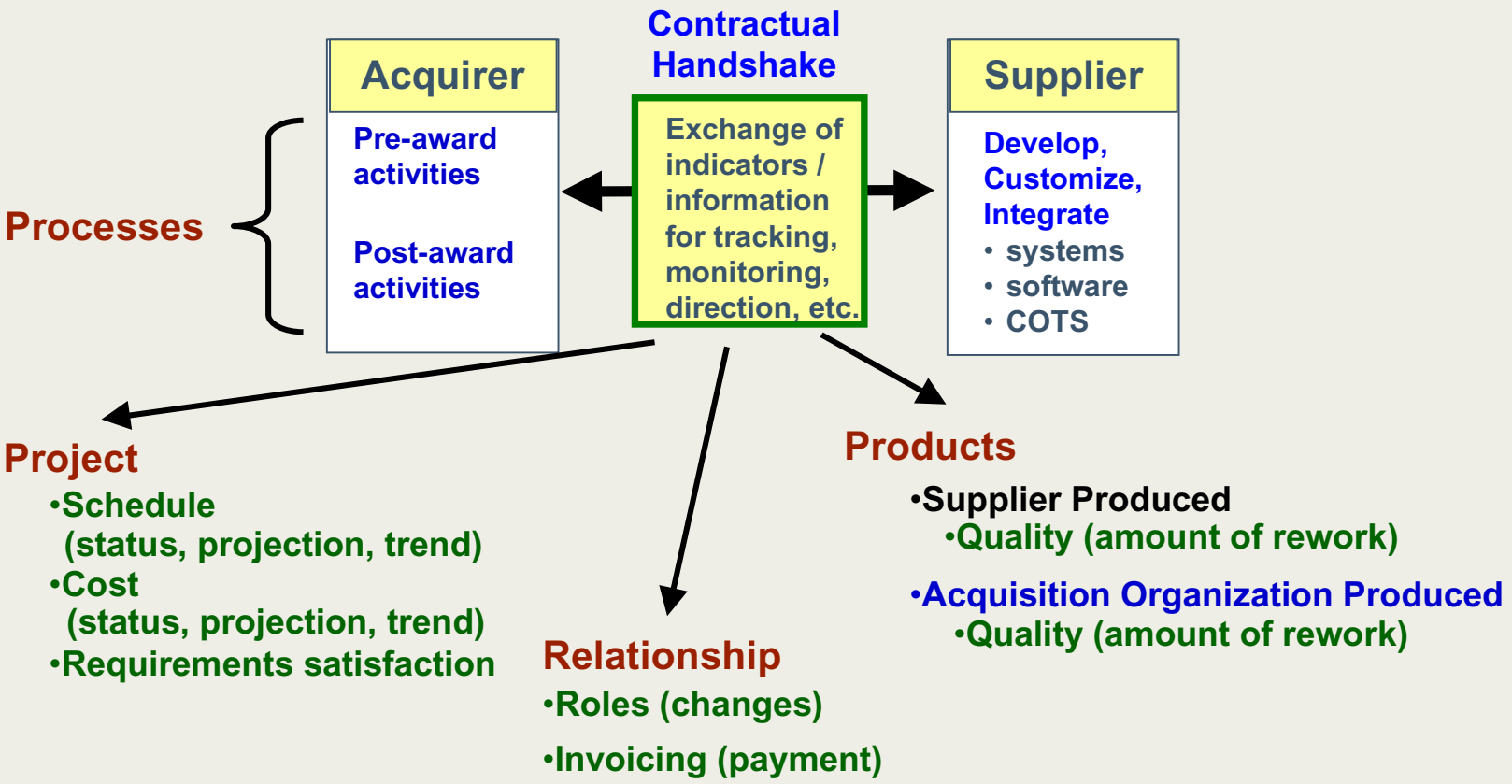
Acquisition Measurement Themes

Project Management
- project execution
- contract relationship

Product Life Cycle & Performance
- product planning
- product development
- deployment
- maintenance

Process & Organizational Infrastructure
- process definition and execution
- relationship management

Measuring Project, Product, Process



Responsibilities Prior to Contract Award

Scope definition

Vendor selection
- technical capabilities
  - proposed scope
- process capabilities
  - predictable, productive performance
  - ability to deal with change
- financial capabilities

Contract negotiation
- quality management metrics
- change management
- managing & monitoring the relationship

Responsibilities After Contract Award

Contractor

Develop the System

Deliverables

Documents
- SRD
- SDP
- Measurement Plan
- SDD

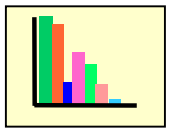
Status Reports
- Schedule
- Cost
- Testing

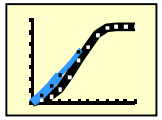
Final Product

ACQUIRER

Acquirer Responsibilities (Post-Contract Award)

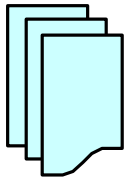
- Evaluate Quality of Deliverables
- Monitor and Oversight
  - Schedule & Progress
  - Resources & Costs
  - Developer's Processes





Monitor & Oversight

Status Information



- schedule progress
- budget status
- test results
- process results, such as inspections
- process compliance

Acquirer's Analysis & Review Process

Acquirer's Evaluation Criteria

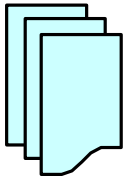
Measurable Results (Examples)

- contractor effort actual vs. plan
- contractor schedule actual vs. plan
- defects reported
  - description, severity, class, type
- size, complexity of the work product

Indicators

Evaluate Quality of Deliverables

Documents to review
- SRD
- SDP
- Meas Plan
- SDD



Final Deliverables

Acquirer's Inspection or Review Process

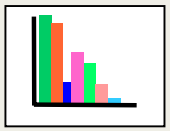
Acquirer's Evaluation criteria

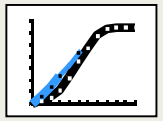
Measurable Results (Examples)

Products
- defects discovered
- description, severity, class, type
- size of the work product

Process
- effort invested in the inspection process
- time spent during the inspection activities

Indicators





Success Factors

To make this work you need:

- technical capabilities
  - integration, validation, deployment
- process capabilities
  - project management, QA, change control
- domain knowledge
  - product uses, stakeholders, quality goals
- relationship management
  - contracting, change management, roles, payment, relationship reviews….

And measurement to see that these things are working well.

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Summary

Adapting CMMI for Acquisition

In addition to establishing these Process Areas (PAs)

- Supplier Agreement Management
- Integrated Supplier Management

You may also need to use these PAs for your acquisition processes and extend them to include your supplier:

- Requirements Management, Development
- Integrated Teaming
- Decision Analysis and Resolution
- Organizational Environment for Integration
- Organizational Process Performance
- Quantitative Project Management
- Causal Analysis and Resolution
- Risk Management
- Project Monitoring and Control
- Verification & Validation
- Configuration Management
- Measurement and Analysis

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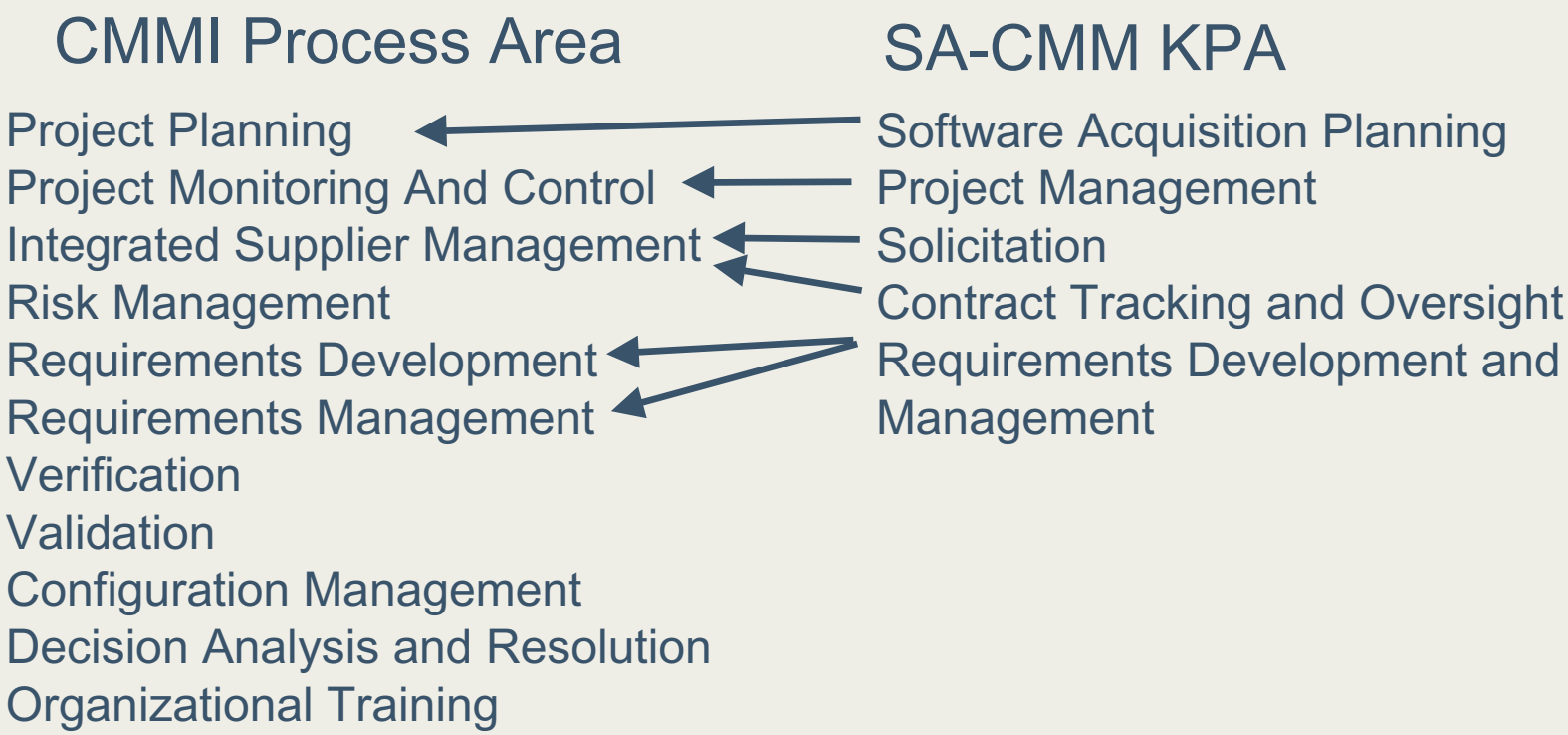
SA-CMM Key Process Areas

Level	Focus	Key Process Areas
5 Optimizing	*Continuous process improvement*	Acquisition Innovation Management Continuous Process Improvement
4 Quantitative	*Quantitative management*	Quantitative Acquisition Management Quantitative Process Management
3 Defined	*Process standardization*	Training Program Management Acquisition Risk Management Contract Performance Management Project Performance Management User requirements Process Definition and Maintenance
2 Repeatable	*Basic project management*	Transition to Support Evaluation Contract Tracking and Oversight Project Management Requirements Development and Mgt. Solicitation Software Acquisition Planning
1 Initial	*Competent people and heroics*	

Higher Quality Productivity
Lower Risk

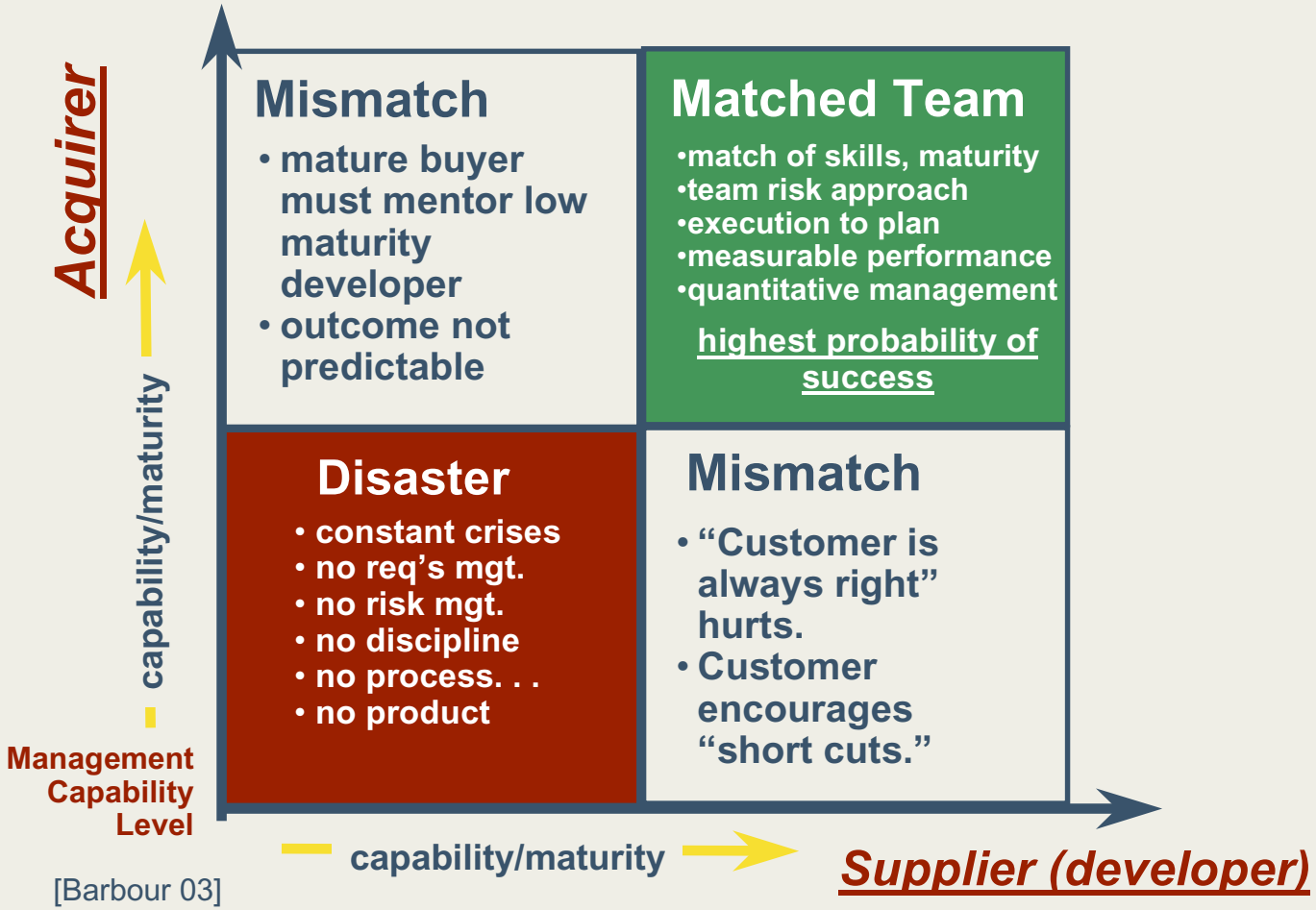
Higher Risk
Rework

Relation to CMMI PAs



[Ferguson 03]

Maturity Matching Considerations



[Barbour 03]

Focusing In

Key points:
- trends in contracting
- common problems and issues faced when contracting
- common view of the roles and responsibilities of an acquirer
- role of reference models

What's in sight:
- measurement and analysis techniques

In the distance:
- an illustration of these techniques at work

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Summary

Benefits of Using Measures

Measurement by itself does not control or improve; it gives insight for objectively planning, managing, and communicating.

- historical data help us predict and plan
- actual versus plan data help us determine progress and support decision making
- analyzing trends helps us identify and focus on problem areas
- project data provide a basis for objective communication

Measurement in CMMI Process Areas

Project Management
- Project Planning, Project Monitoring and Control, Software Acquisition Management
- Integrated Project Management, Risk Management, Integrated Supplier Management
- Quantitative Project Management

Process Management
- Organization Process Focus, Organization Process Definition
- Organization Process Performance
- Organization Innovation and Deployment

Engineering -- All

Support
- Measurement and Analysis, Process and Product Quality Assurance
- Decision Analysis and Resolution
- Causal Analysis and Resolution

[DZ –P 03]

Measurement in CMMI Generic Practices

"Monitor and control the process against the plan and take appropriate corrective action." (GP2.8)

"Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets." (GP3.2)

Two uses of measurement:
- project management
- process improvement

As the organization matures, the sophistication and uses of measurement increase.

[DZ 02]

Measurement in SA-CMM

Maturity Levels 2-5

- **status** of
  - processes
  - products

Maturity Levels 4-5

- **effectiveness** of
  - processes
  - products

Acquisition Enterprise Measurement

Execution of a contracted project also involves

- legal processes
- financial processes

While this tutorial does not explore these aspects of contracting, each aspect is measurable and can be quantitatively managed.

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Sources for Measures

Goal-Driven (Software) Measurement (GDM)

Goals → Questions → Indicators → Measures (GQIM)
USER DEFINES INDICATORS & MEASURES
Based On: • what's needed to manage the User's goals • decisions and decision criteria related to managing the user's goals

Practical Software & Systems Measurement

Common Issue Area →	Measurement Category →	Measures
PREDEFINED	***PREDEFINED***	***PREDEFINED***

Goal-Driven Measurement (GDM)

When using goal-driven measurement, the primary question is NOT:

"What metrics should I use?"

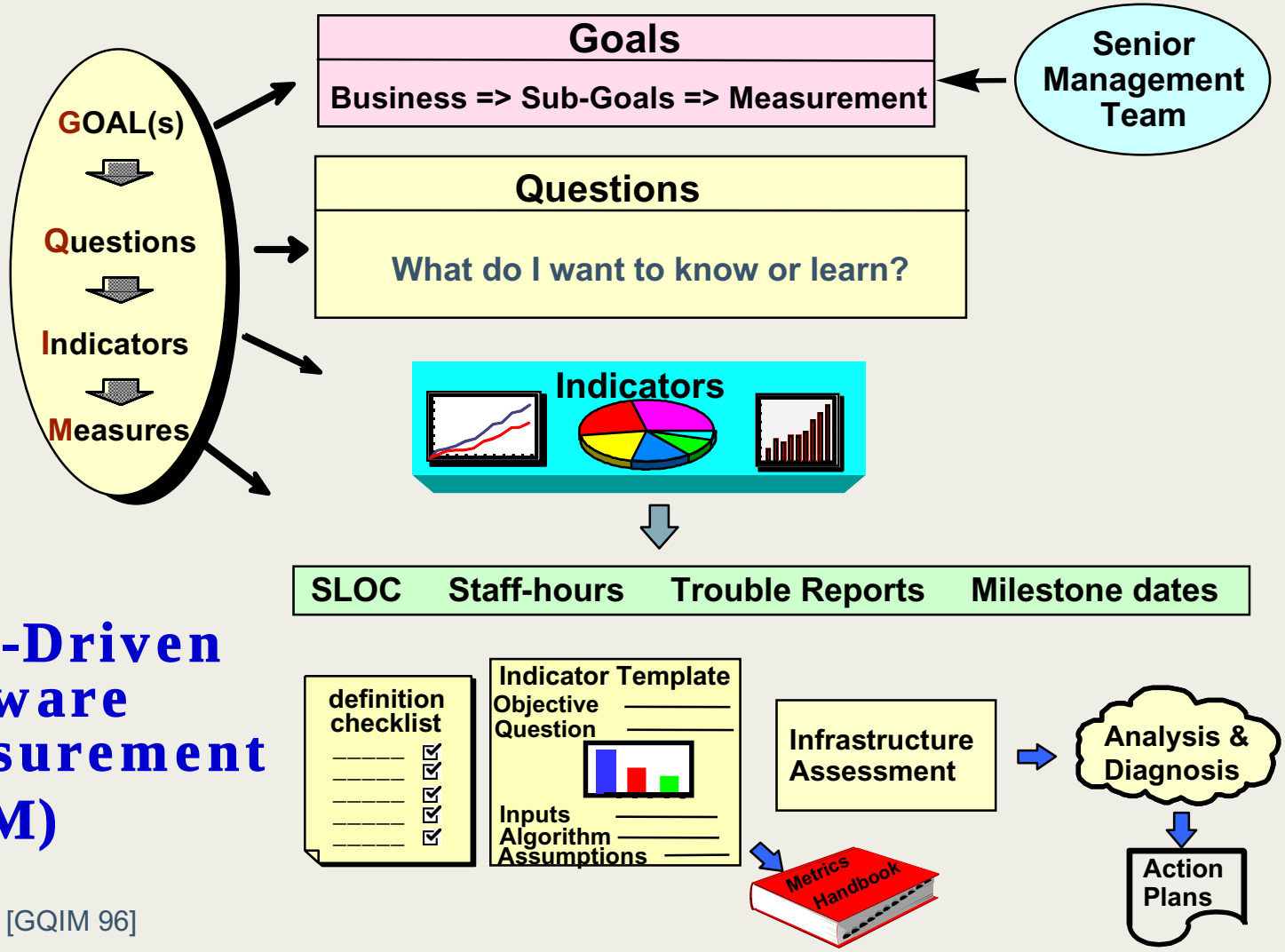
rather, it is:

"What do I want to know or learn?"
"What decision do I want to make?"

Goal-driven measurement is NOT based on a predefined set of metrics.

[GQIM 96]

Goal-Driven Software Measurement (GDM)



[GQIM 96]

Practical Software & Systems Measurement (PSM)

This measurement process is funded by the DoD and is freely available at http://www.psmsc.com.

PSM process identifies project-specific issues:

- issues grouped into common software issue areas
- measurement categories correspond to issue areas
- each measurement category has a candidate set of proven measures

Measures are selected based on availability, environment, and other factors.

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PSM Common Software Issues – Measurement Categories

Schedule and Progress
- Milestones Performance
- Work Unit Progress
- Incremental Capability

Product Size and Stability
- Product Size and Stability
- Functional Size and Stability

Process Performance
- Process Compliance
- Process Efficiency
- Process Effectiveness

Customer Satisfaction
- Customer Feedback
- Customer Support

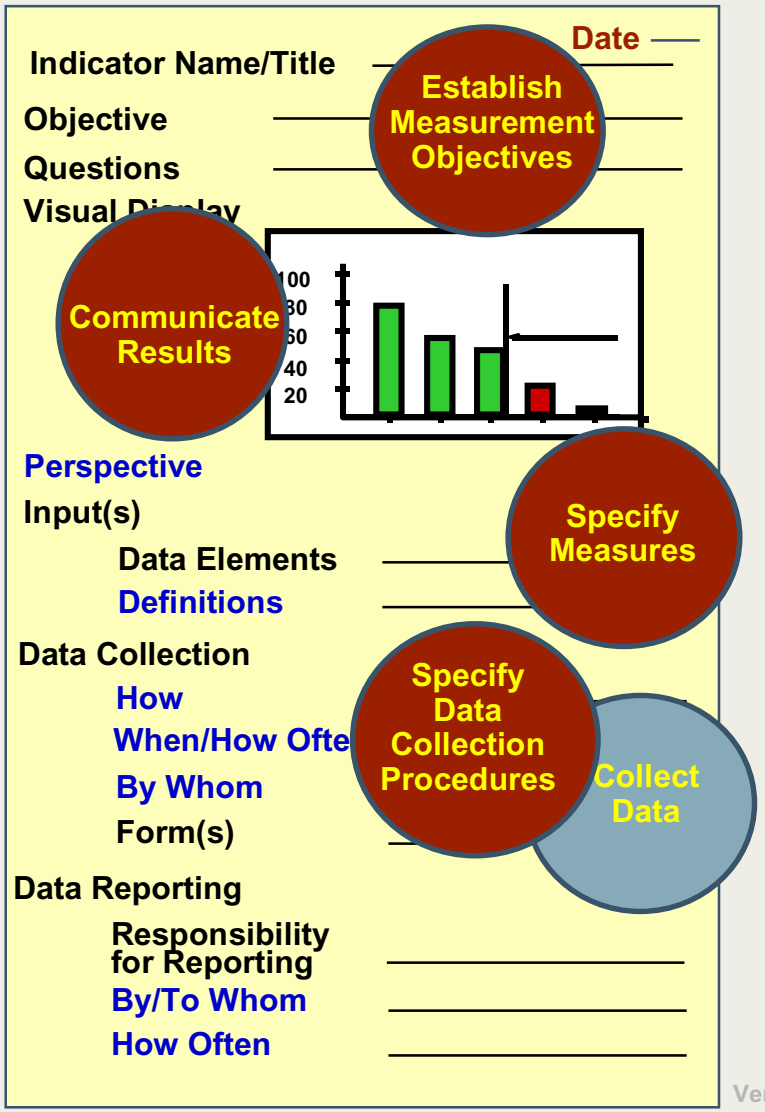
Resources and Cost
- Personnel
- Financial Performance
- Environment Availability

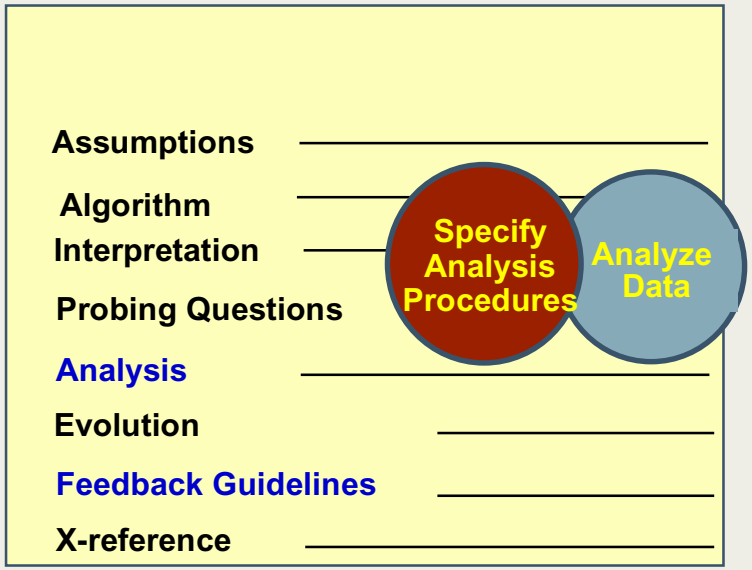
Product Quality
- Functional Correctness
- Supportability - Maintainability
- Efficiency
- Portability
- Usability
- Dependability - Reliability

Technical Effectiveness
- Technology Suitability
- Impact
- Technology Volatility

[PSM 00]

Modified Indicator Template





Additional Modifications by clients

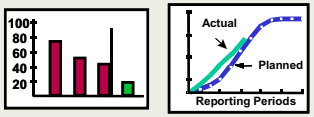
- streamlined data collection & reporting sections using "swimlane" diagrams
- Addition of "corrective action guidelines"
- Subprocess selection (for CMMI)

[GQIM], [DZ 02]

Indicator Classifications

GQ(I)M

Roll-up For
Higher Management



Analysis Indicators

What are results of specific tasks?

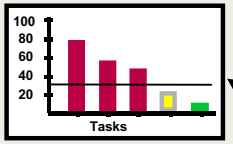
Goal

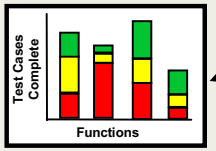
Success Criteria

Strategy to accomplish the goal

Tasks to Accomplish goal

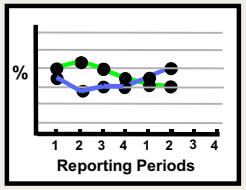
Task 1
Task 2
Task 3
•
•
Task n





PSM, GQ(I)M

GQ(I)M

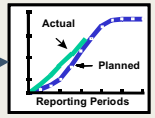


Success Indicators

Have the goals been achieved? What is the impact of the tactics?

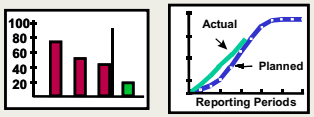
PSM

For
Project Manager



GQ(I)M

Roll-up For
Higher Management



Progress Indicators

How well are plans proceeding?

Data Analysis Dynamics

Getting Started
- Identify the goals
- Black box process view
- Is the data right?
- Do I have the right data?

Decision point:
- If the data is not perfect, do I move forward or obtain better data?

Initial Evaluation
- What should the data look like?
- What does the data look like?
- Can I characterize the process, product, problem?

Decision point:
- Can I address my goals right now?
- Or is additional analysis necessary? at the same or deeper level of detail?
- Can I move forward?

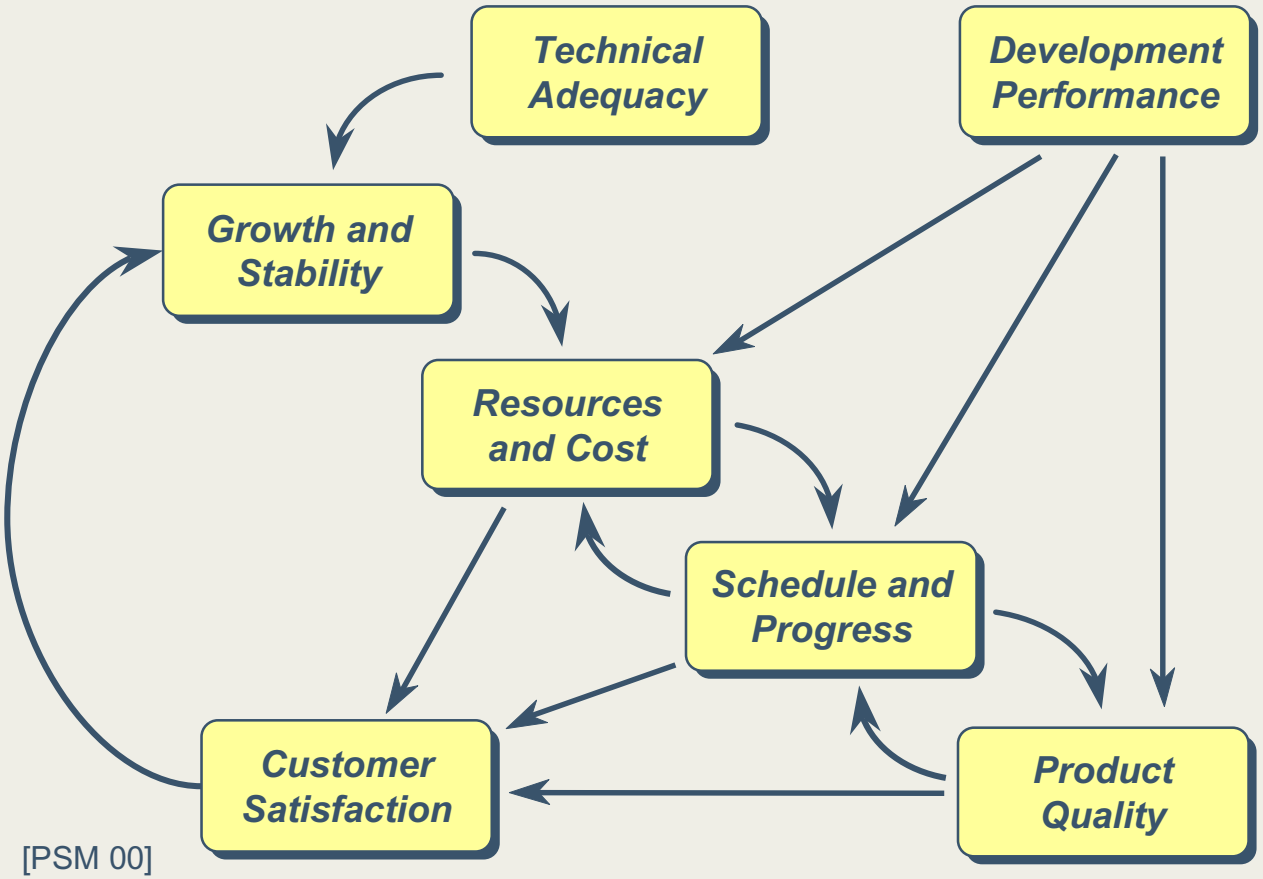
Moving Forward
- Further evaluation
- Decompose data, process

Decision point:
- Do I take action?
- What action do I take?

Repeat until root cause found, at target with desired variation

[DAD 03]

Performance Analysis Model



[PSM 00]

Performance Analysis Checklist 1

Single indicator issues:

- Do actual trends correspond to planned trends, such as progress, growth, and expenditures? How big is the variance?
- Does the variance appear to be gradually growing each month?
- Are actual values exceeding planned limits, such as open defects, changes, and resource utilization?
- Are outliers or other anomalies affecting the results?

[PSM 00]

Performance Analysis Checklist 2

Integrated indicator issues:

- Is the source of the problem evident?
  - Change in functionality, unplanned rework, etc.
- Are growing problems in one area a leading indicator of other problems later in the project?
  - Requirements creep impact on schedule
- Do multiple indicators lead to similar conclusions?
  - Lack of progress correlates with low staffing
- Does other project information contradict performance results?
  - Milestones being met but open defect counts are increasing

[PSM 00]

Focusing In

Earlier:
- trends, roles, models

Key Points:
- measurement in maturity models
- three indicator types: success, progress, analysis
- comparing PSM and GQIM
- Performance Analysis Model

What's in sight:
- an illustration of these methods at work

Outline

Context
- state of the community
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Background
- roles & responsibilities
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Illustration
- goal-setting and success, progress, analysis indicators
- inspecting the quality of deliverables: requirements
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Summary

Composite Illustration*

This illustration is based on an organization that is

- maintaining an existing product, a blend of COTS, and internally developed code
- pursuing the acquisition of a replacement product

Their acquisition includes two contracts:

- requirements development
- product design, code, and test

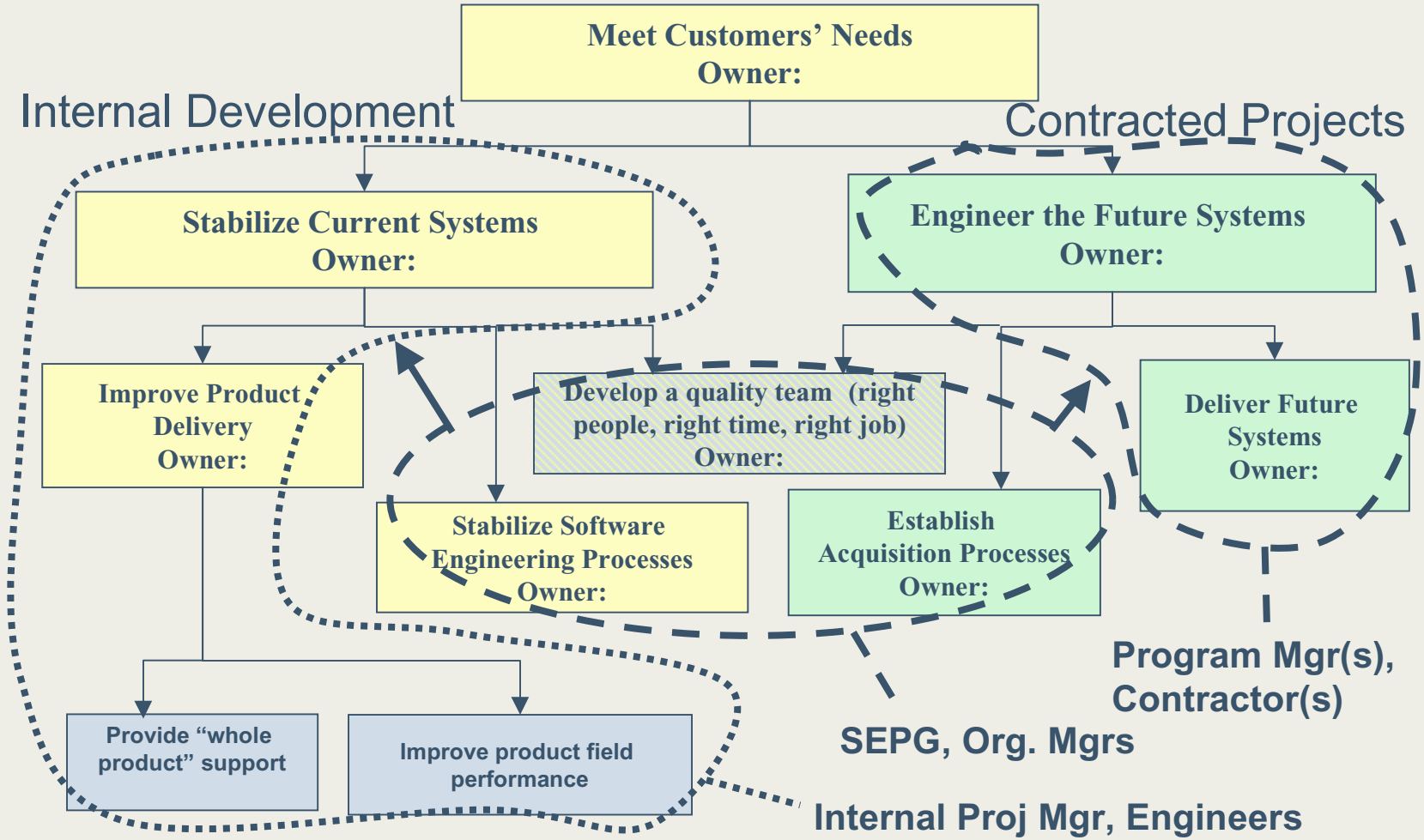
This illustration will focus on

- evaluating requirements document quality (contract 1)
- analyzing project execution data (contract 2)

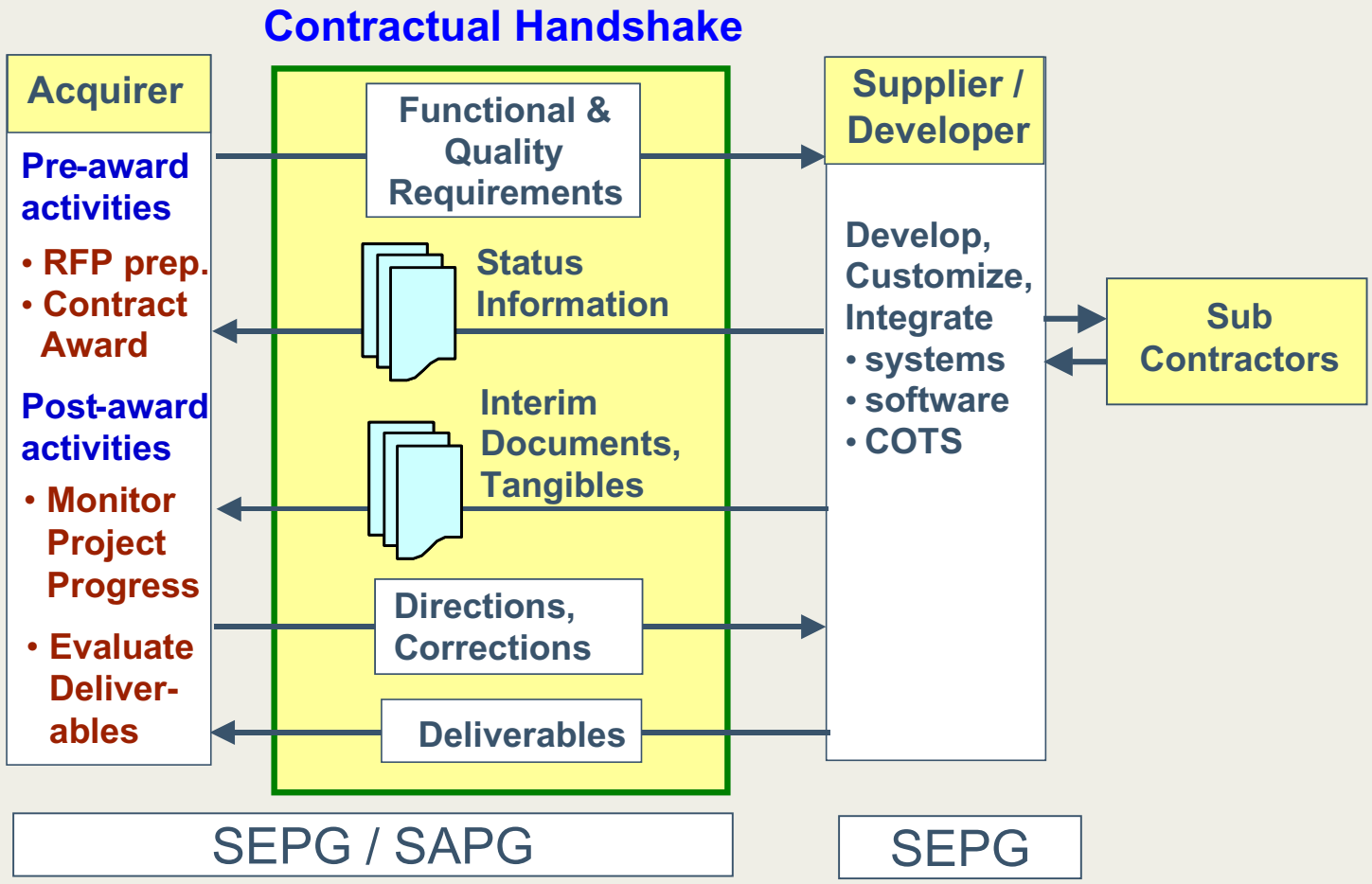
It will briefly highlight other aspects of acquisition measurement.

*This illustration is a composite of two projects. Aspects from other projects have been interwoven for demonstration purposes.

Illustration: Goal Structure



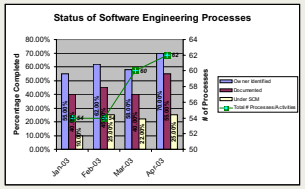
Roles and Information Exchange



Sr. Mgmt scorecard ;
Middle Mgmt dashboard

Goal:
Establish Acquisition Processes

Success Criteria



Success Indicators

process owners, training, CM, and documentation
(future: procedural adherence)

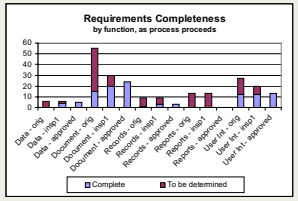
Strategy to accomplish goal

- Reference models: CMMI, SA CMM, IEEE/ISO 12207
- Leverage CMMI capabilities built in engineering: MA, REQM, RD, CAR
- Aim for CMMI capability in selected PAs: SAM, DAR, RSK, PP/PMC, CM, PPQA
- Reference all SA-CMM Level 2 kPAs, noting overlaps with CMMI

Sr. Mgmt dashboard
- quality trends
- selected project EV data

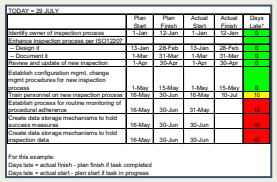
Middle Mgmt dashboard
- system documentation and testing

Middle Mgmt Dashboard
- selected SPI plan EV data



Tasks to Accomplish goal

- Implement requirements management process
- Tailor existing project monitoring processes for acquisition managers
- …..



Analysis Indicators

Reqts completeness – original, at inspection, approved (for contract 1)

Progress Indicators

start, finish dates
with progress noted
(move toward EV)

Outline

Context
- state of the community
- changing perspectives

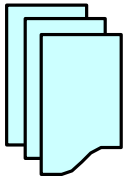
Background
- roles & responsibilities
- maturity models
- measurement & analysis methods

Scenario
- goal-setting and success, progress, analysis indicators
- inspecting the quality of deliverables: requirements
- monitoring and oversight: progress analysis
- measurement in the contract
- communicating with integrated measures

Summary

Evaluate Quality of Deliverables

Documents to review
- SRD
- SDP
- Meas Plan
- SDD



Final Deliverables

Acquirer's Inspection or Review Process

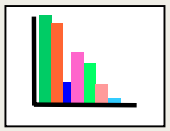
Acquirer's Evaluation criteria

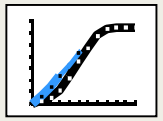
Measurable Results (Examples)

Products
- defects discovered
- description, severity, class, type
- size of the work product

Process
- effort invested in the inspection process
- time spent during the inspection activities

Indicators





Requirements Development & Management (SA-CMM RDM)

Purpose:
To establish a common understanding of the software requirements by the acquisition project team, the end user, and the contractor.

- includes both technical and non-technical requirements
- involves development of the requirements and management of any changes
- starts with description of an operational need and ends with transfer of responsibility to the maintainer

RDM - Measurement Opportunities

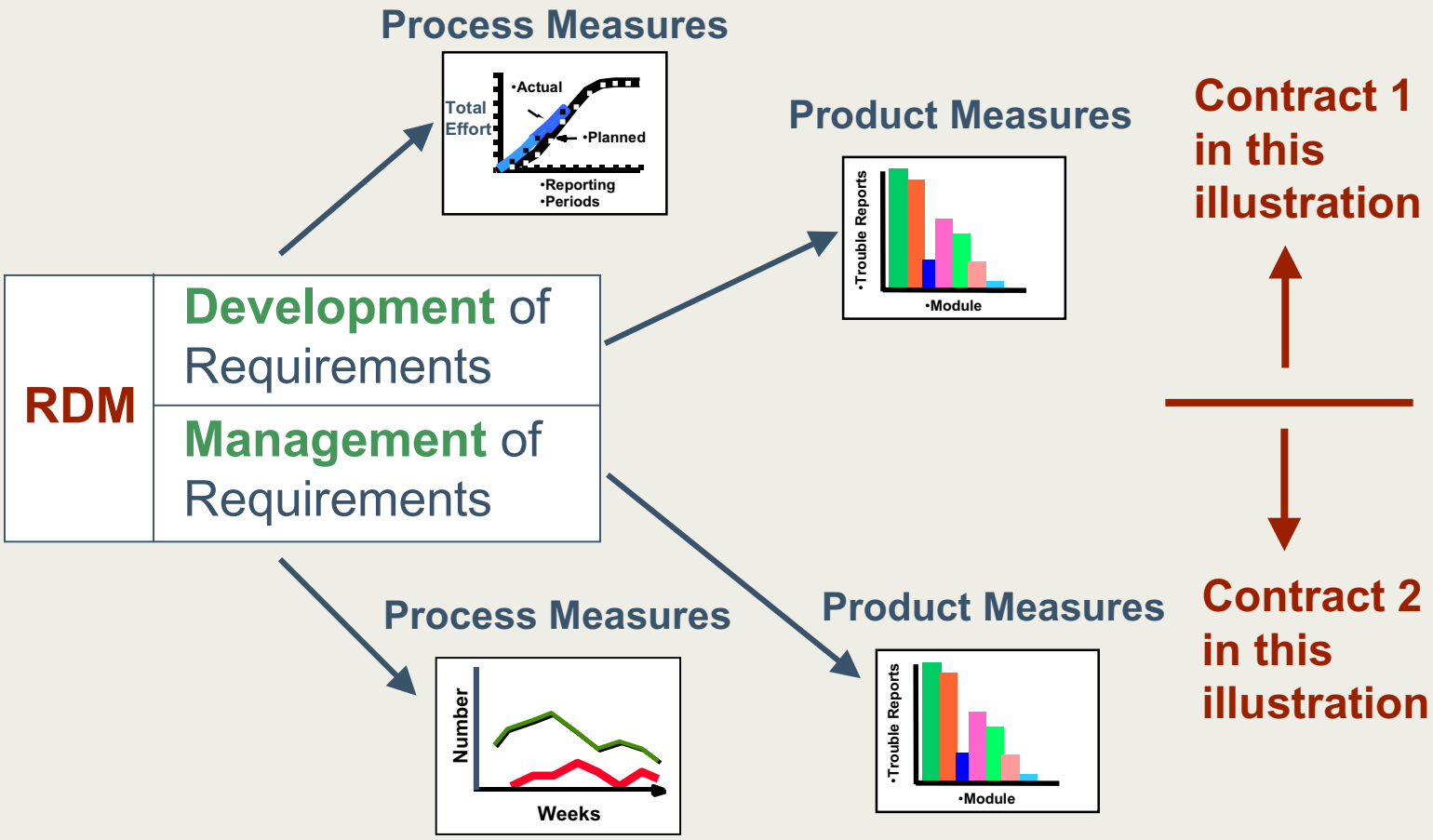
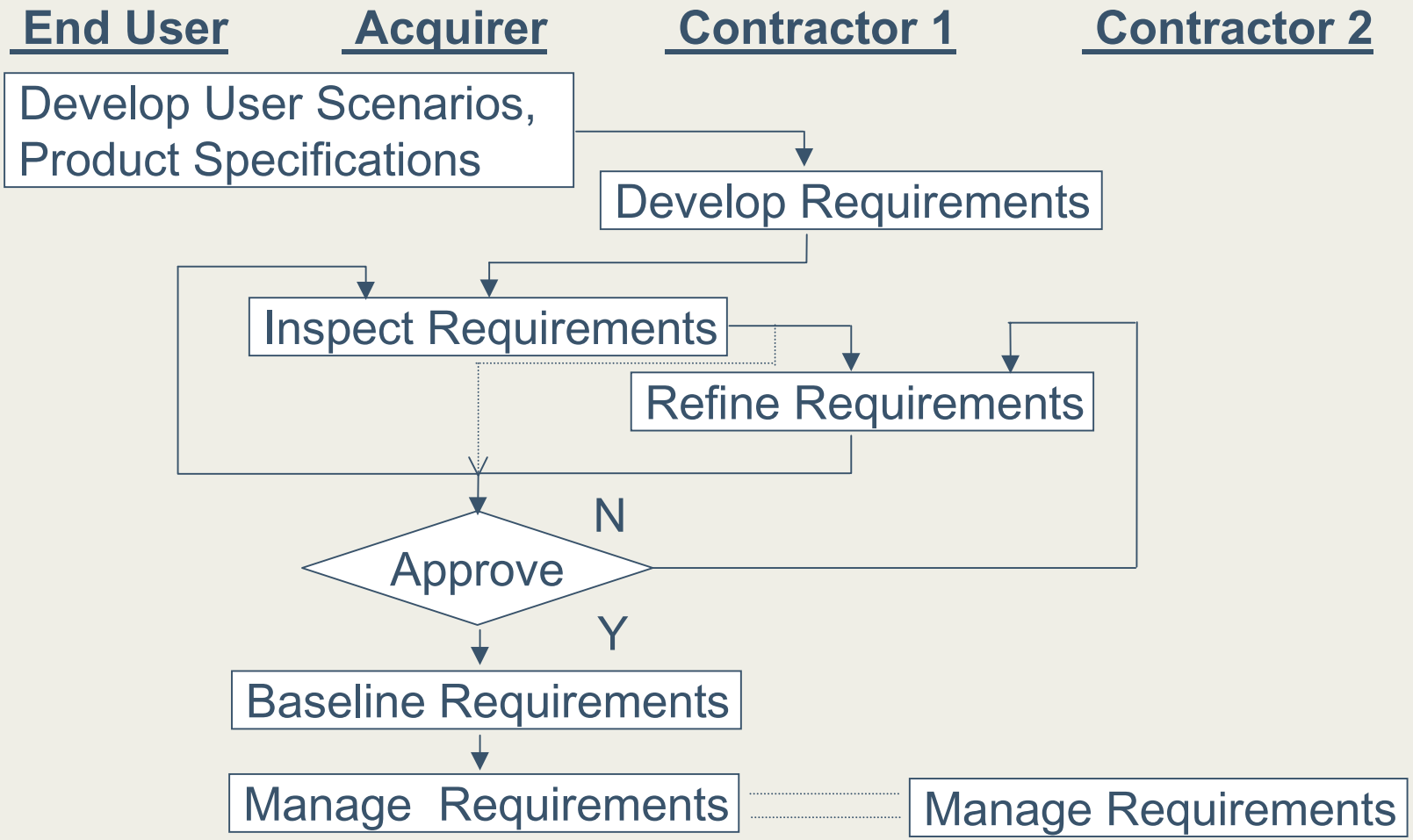


Illustration: Reqts Process Flow



Requirements Process Measures

Process Measures

- effort expended
- funds expended
- progress toward completion
- completion of milestones
- number of change requests processed (post-development)

For the contractor, these are measures of development process.

For the acquirer, these are measures of the inspection process.

Requirements Document Measures and Evaluation Criteria

"Inch" or "thickness" Criterion
- Document is at least three inches thick

"Drop it" or "Thud" Criterion
- Related to inch criterion
- Specific level of sound before it is accepted

Format
- Pretty pictures
- In color

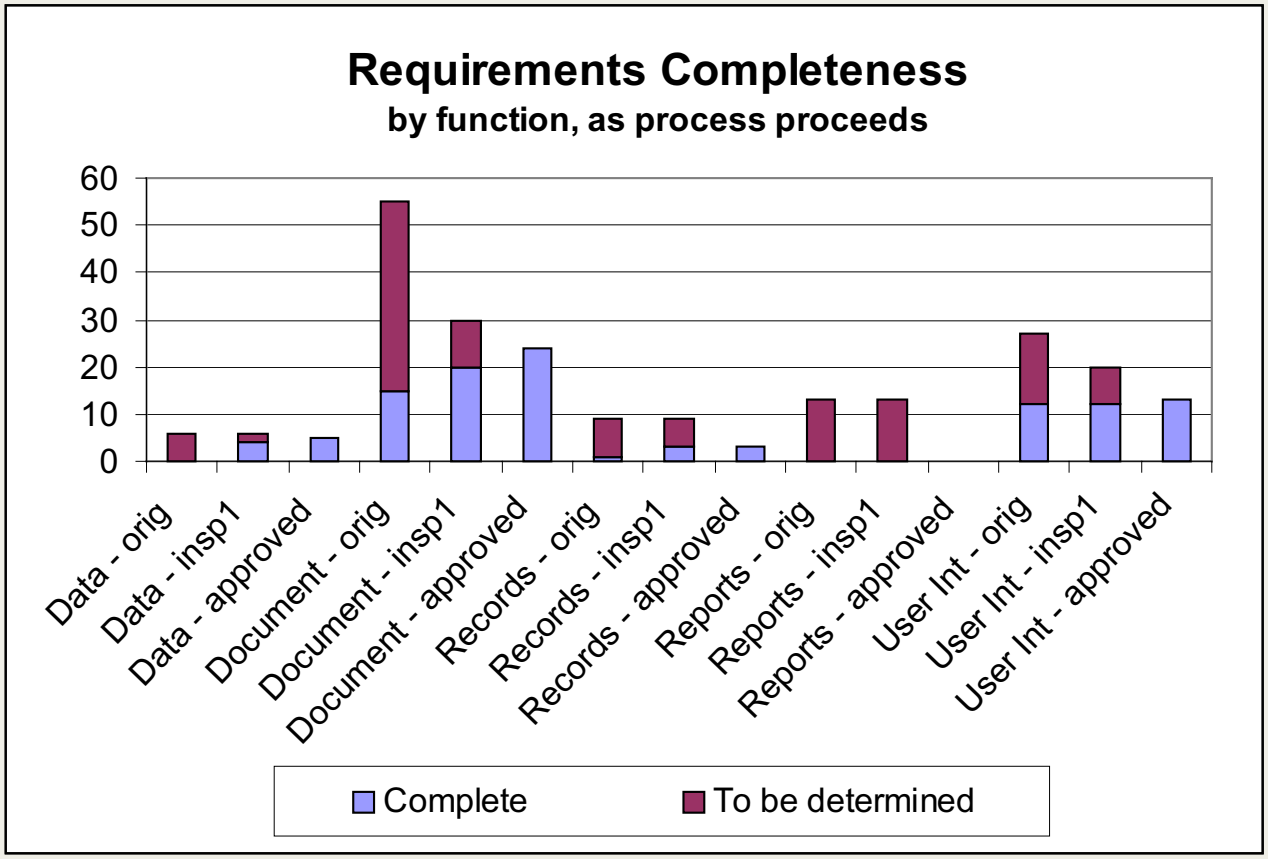
Requirements Document Effective Evaluation Criteria

Examples of measurements for evaluation criteria

- completeness:
  - "TBD" requirements;
  - product performance measures included
- consistency:
  - no conflicts across document sections
- clarity:
  - growth in issues,
  - presence of ambiguous language or words with many meanings.
- conformity:
  - meets stated criteria, constraints
- correctness:
  - all data fields in valid ranges

Contract should contain evaluation criteria.

Illustration: Requirements Indicator



Practical Issues

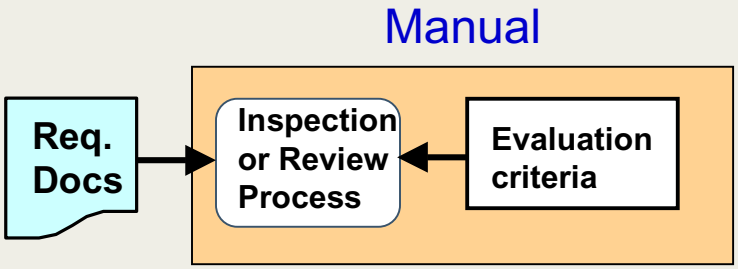
The organization or program/project office may have several barriers to effective document inspection, such as

- insufficient quantity/availability of personnel
- insufficient technical or domain knowledge
- schedule constraints

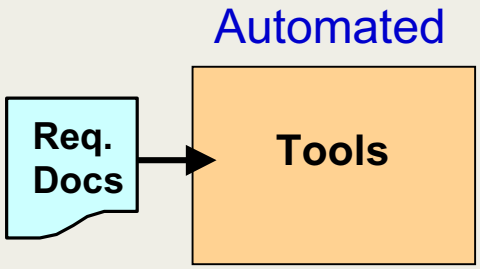
Example:

- If you have a 300 page requirements document and typically inspect at a rate of 2 hrs/page, are there resources available to invest 600 hours to inspect that document?

Advancing the State of Requirements Product Measures



Lengthy, labor intensive process



Reduce cycle time and effort while producing better results than possible with tedious manual review

Examples of Tools:

- Quality Analyzer for Requirements Specifications (QuARS)
  - Lexical, syntactic and semantic analyses of requirements
- Automated Requirements Measurement (ARM)

Quality Analyzer for Requirements Specification

How does it work?

- natural language analysis of requirements text
- lexical: vague, weak, optional, subjective, other terms
- syntactic: multiple, implicit, under specified statements
- semantic:
  - allows screening for consistency, completeness, etc.
  - arbitrary combinations of domains, components, functionality, product quality attributes, and so on

Automated Requirements Measurement (ARM)

Checks for desirable requirements characteristics such as:

- complete: precisely define all real world situations
- consistent: no conflict between individual requirements
- correct
- modifiable
- ranked
- traceable
- unambiguous: can only be interpreted one way
- understandable: meaning of each of its statements is easily grasped by all of its readers
- verifiable
- validatable: by individuals and organizations having vested interest
- testable

Focusing In

Earlier:
- trends, roles, models
- measurement methods

Key Points:
- quality of deliverables
- effective evaluation criteria
- measuring requirements development (contract 1)
- tools for analyzing requirements

What's in sight:
- monitoring and oversight: evaluating a schedule slip (contract 2)
- What would YOU include in the contract?

Outline

Context
- state of the community
- changing perspectives

Background
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- maturity models
- measurement & analysis methods

Scenario
- goal-setting and success, progress, analysis indicators
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- communicating with integrated measures

Summary

Monitoring & Oversight

Contract #2 has been awarded.

- supplier is developing the product in two builds

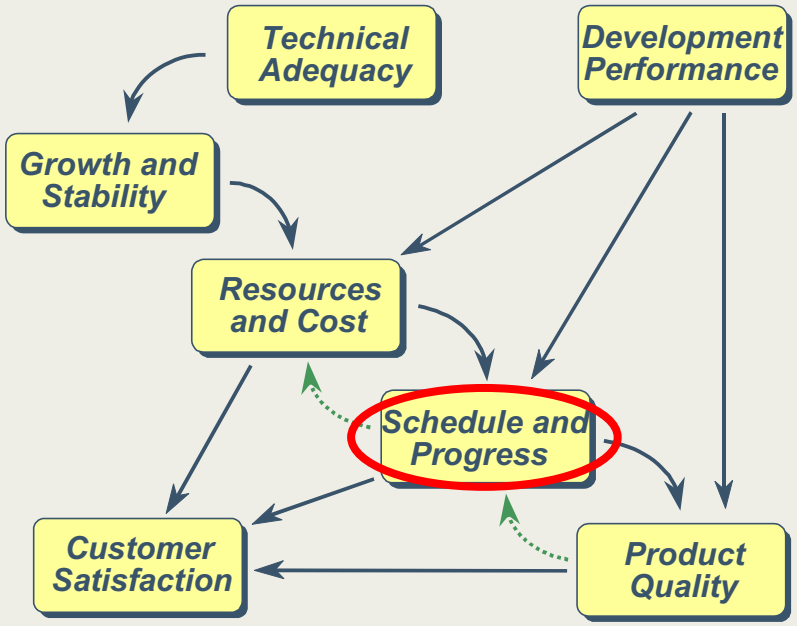
The contractor has just notified you that the project has both cost and schedule slippage.

What do you do?

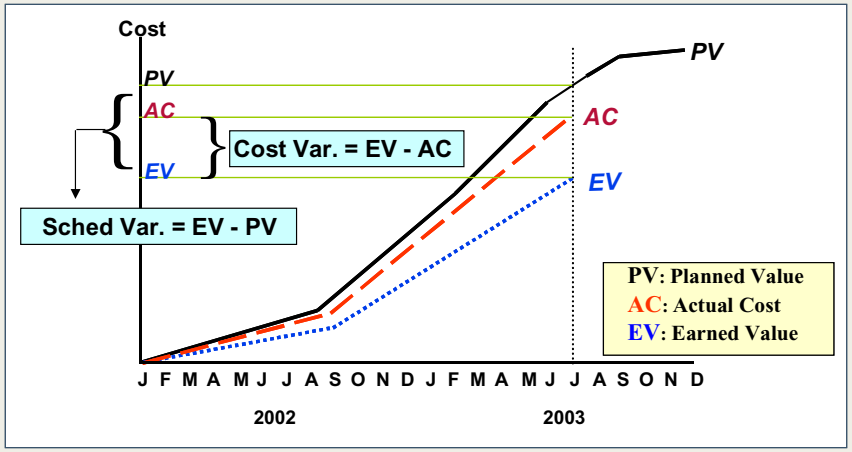
Performance Analysis Model

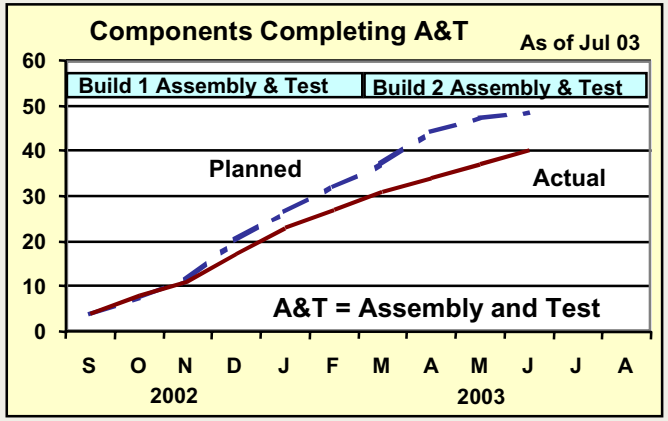
Use model to guide analysis.

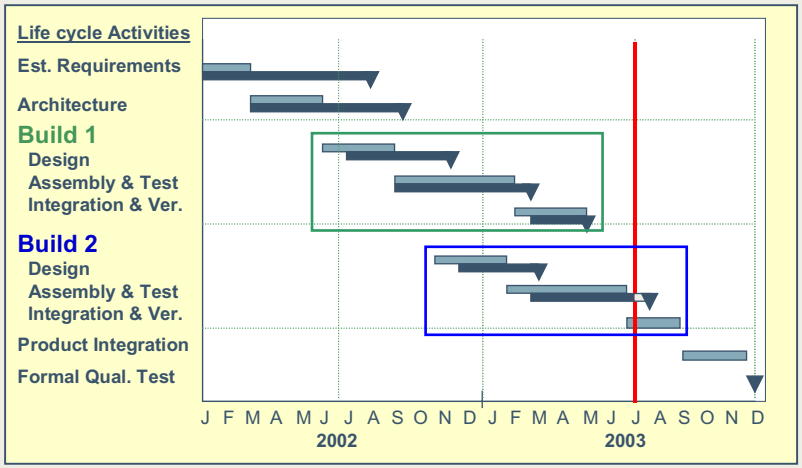
- Step 1: Confirm Problem (Cost & Schedule Slippage)



Schedule & Progress Indicators







Tool tips:

The top two charts were made in Excel and manually manipulated.

The Gantt chart can be generated using any scheduling software.

What We Learned

From Schedule and Progress indicators

- cost and schedule slippage -- *EV chart*
- activities taking longer than planned -- *Gantt chart*
- assembly and test behind schedule -- *components completion chart*

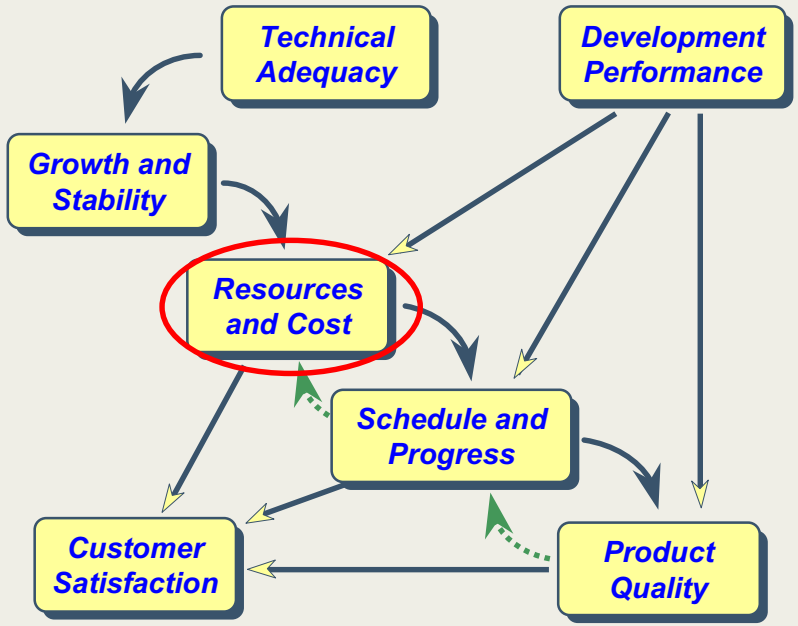
What does this mean?

- confirms we have a problem

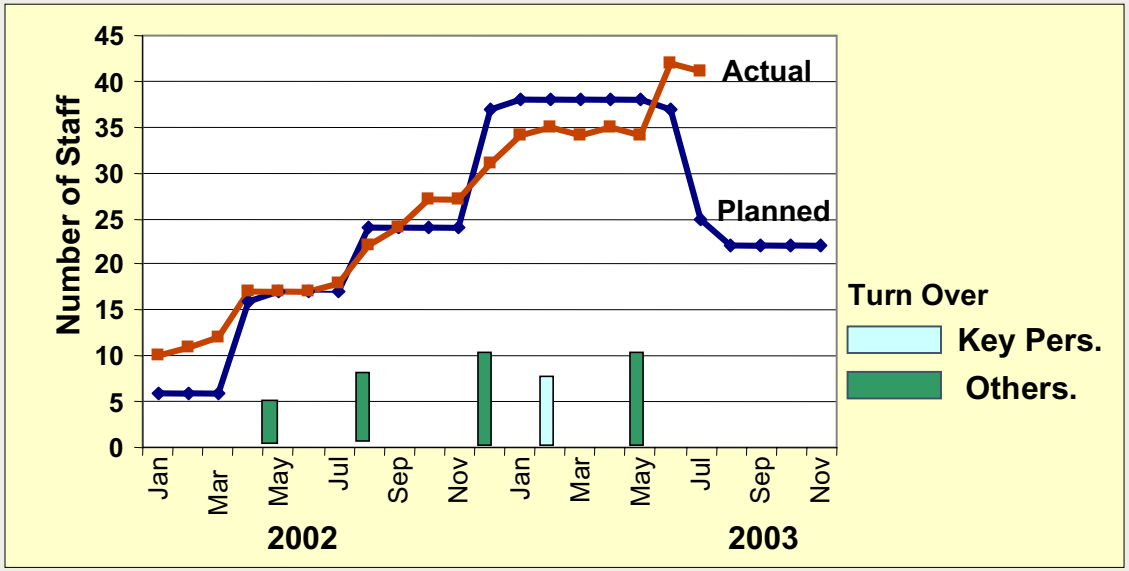
Resources and Cost Indicators

Analysis/Probing Questions

- Is the staff allocation contributing to the problem (too many, too few, wrong time frame)?
- What is rate of staff turnover?
- How does actual staff compare to planned staff allocation?



Resources and Cost Indicators



Prg	Plan				2	3	3	3	9	9	11	12	22	23	23	22	22	22	22	15
	Actual	3	3	4	5	5	5	6	9	9	11	11	15	18	19	19	20	20	30	30

Tester	Plan					1	1	1	3	3	2	2	5	5	7	8	8	8	8	5
	Actual	3	3	3	3	3	3	3	3	5	5	5	5	5	5	5	5	5	5	5

Tool tip: This chart was made in Excel and manually manipulated.

What We Learned

From Resources and Cost Indicators

- staffing did not follow planned level
  - too many at beginning of project
  - testers and programmers used to fill in for analysts and designers => high re-training costs
  - high turnover rate => training & getting up-to-speed costs

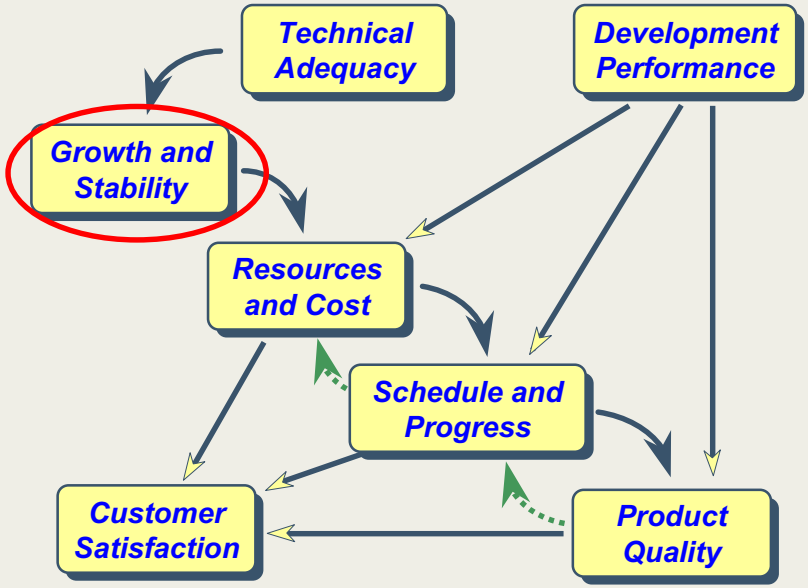
What does this mean?

- cost overrun due partly to staffing problems

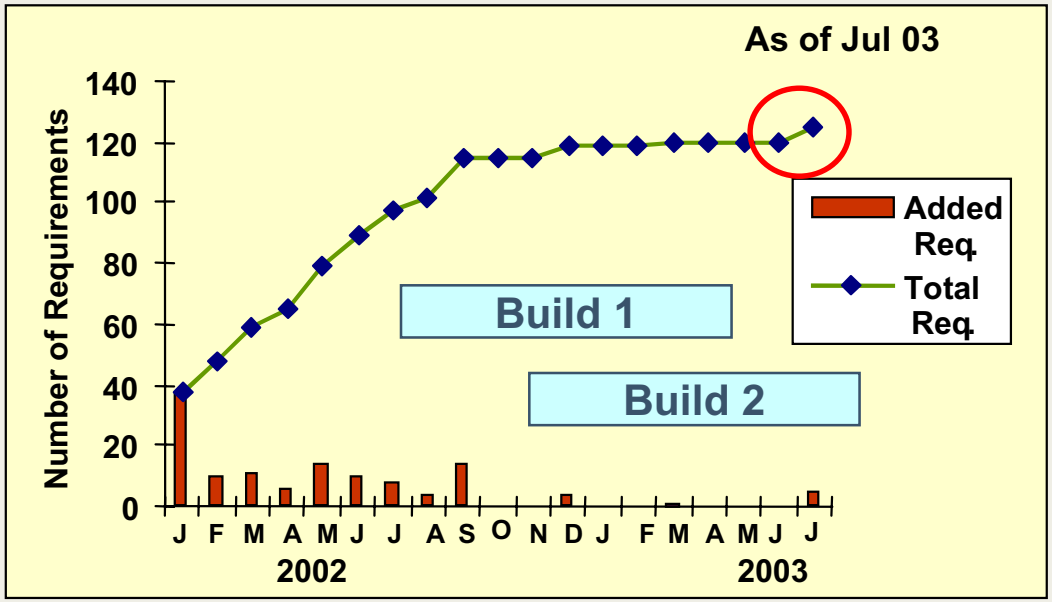
Growth and Stability Indicators

Analysis/Probing Questions

- Are the requirements stable?
- What is the code growth?
- Is functionality being transferred from build 1 to build 2? If so, how does this effect the delivery date?



Requirement Changes Information

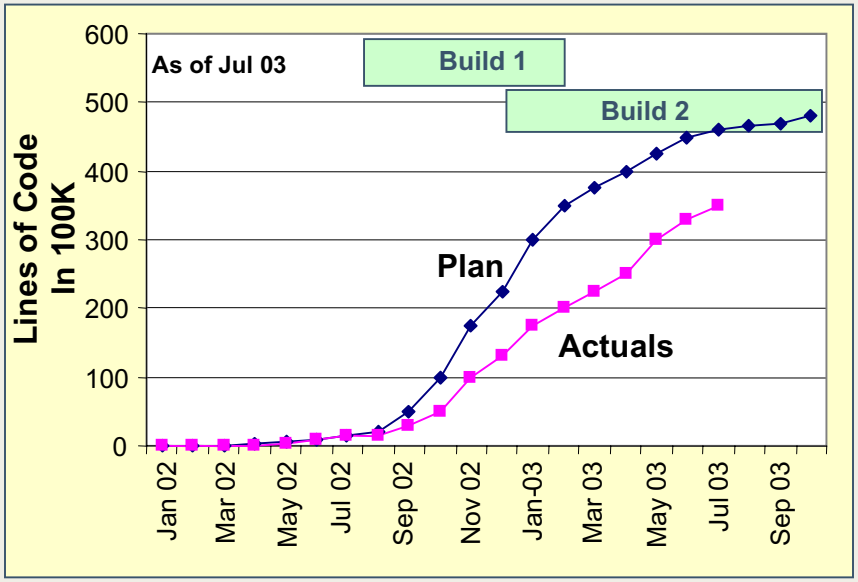


Tool tip: This chart can be generated in Excel followed by manual editing using the drawing toolbar

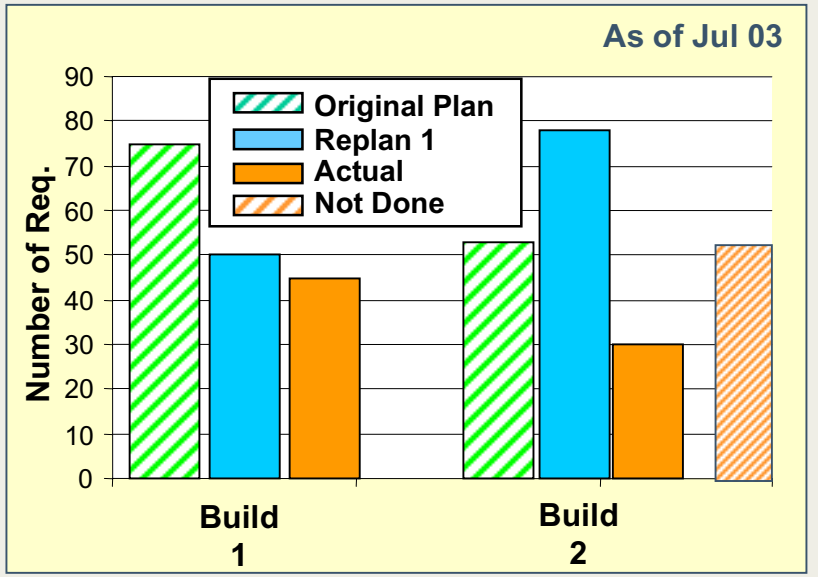
	2002								2003		
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Dec	Mar	Jul
Req Changes	10	11	6	14	10	8	4	14	4	1	5
Complexity	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Resources (staff-days)	4	5	3	2	4	2	3	3	2	1	2

Growth and Stability Indicators

Size Growth



Requirements per Build



Tool tip: This chart was made in Excel and manually manipulated.

Contractor's Explanation:

- Functions deferred to later build because of unanticipated complexity

What We Learned

From Growth and Stability Indicators

- requirement changes are of low complexity but will have some ripple effect
- code production below planned value
- functionality being deferred from build 1 to build 2 attributed by contractor to unanticipated complexity

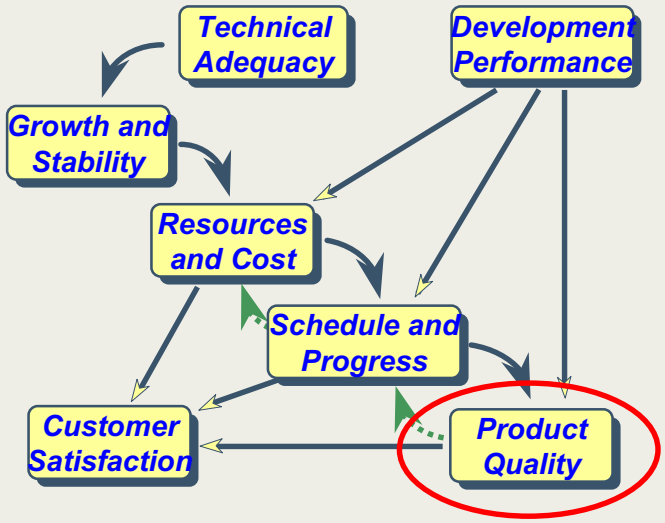
What does this mean?

- expect further cost and schedule growth due to low code production and increased number of functions to be implemented in Build 2
- expect an impact on completion date due to functions deferred to Build 2
- expect the possibility of a “Build 3” proposal

Product Quality Indicators

Analysis/Probing Questions

- Are the defined processes being followed?
- What is the rate of closure for trouble reports?
- What type of trouble reports are being detected? In what phase?



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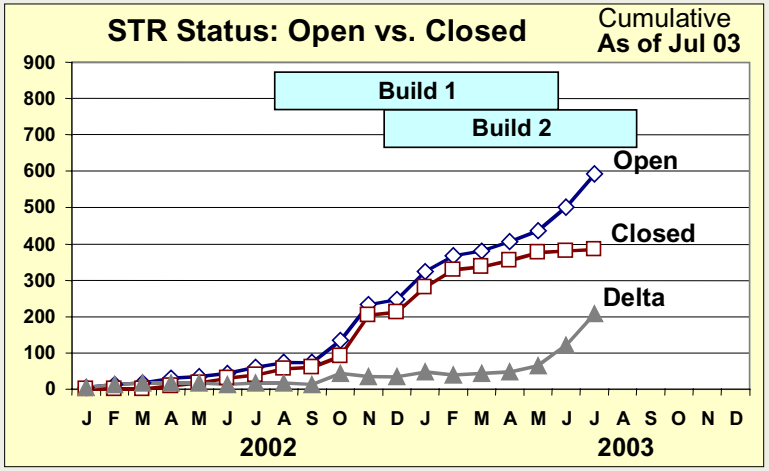
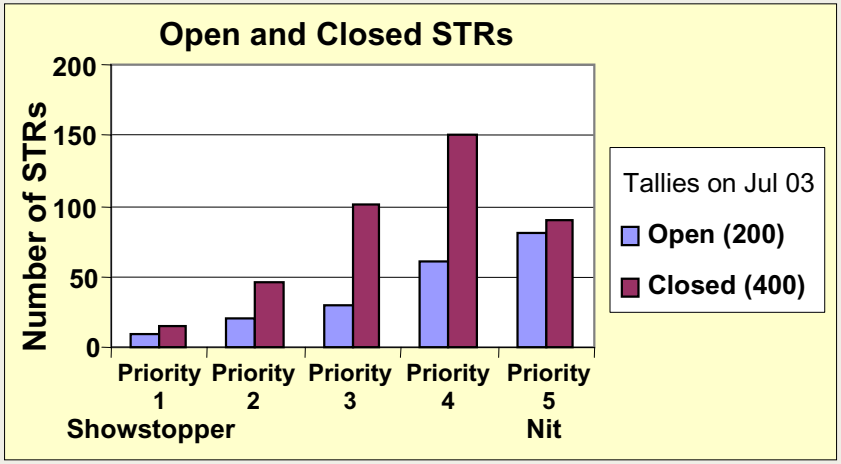
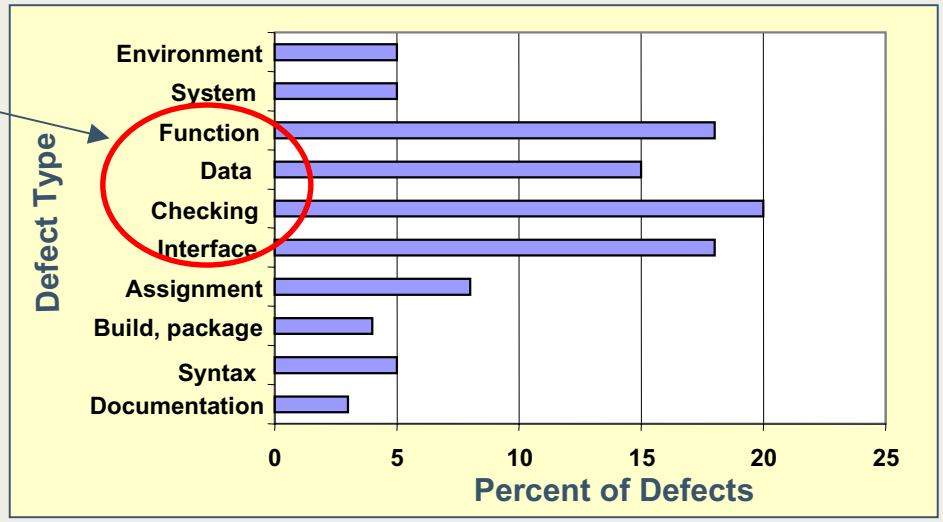




Tool tip: This chart was made in Excel and manually manipulated.

Classifying Trouble Report Defects

Types that code inspections would have been expected to catch



What We Learned

From Product Quality Indicators

- STRs being opened faster than they're being closed
- Code inspections should have found defect types

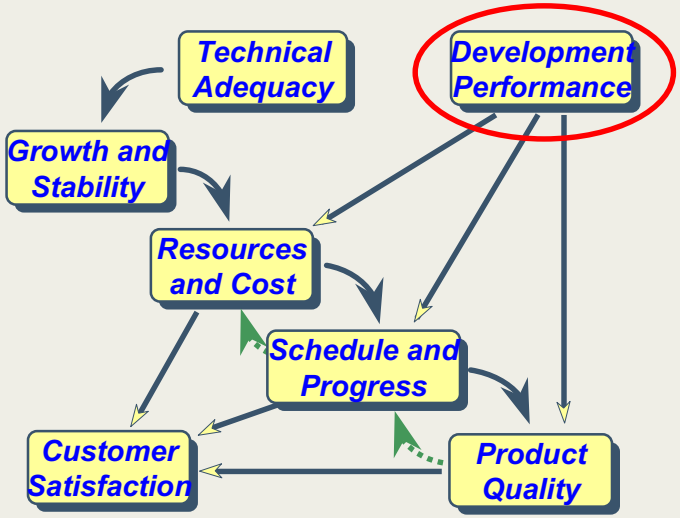
What does this mean?

- Code inspection process allowed large number of defects to slip through.

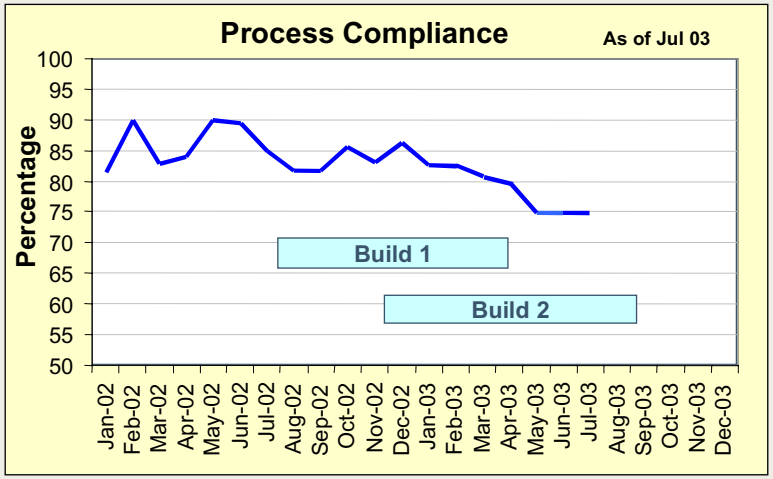
Development Performance Indicators

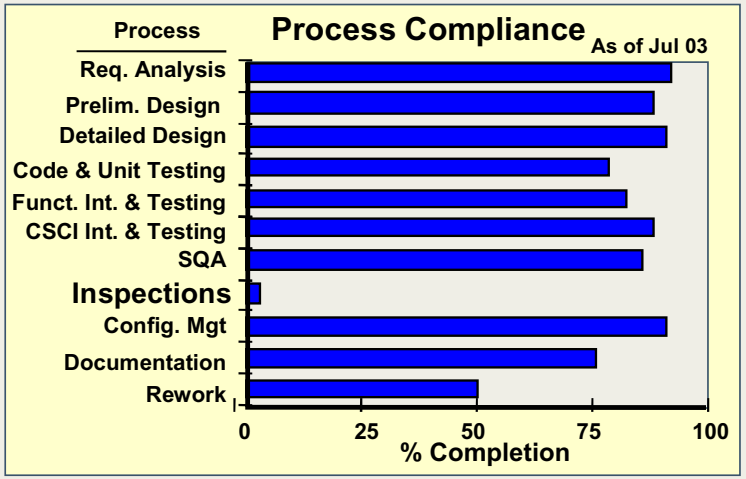
Analysis/Probing Questions

- Are the defined processes being followed?
- Are any defined processes being skipped?



Development Performance Indicators





Tool tip: This chart was made in Excel and manually manipulated.

What We Learned

From Development Performance Indicators

- adherence to defined process decreased over time
- stopped doing inspections

What does this mean?

- defects usually detected during code inspections allowed to slip through
- impact on cost and schedule due to rework

Reasons for Slippage

Staffing problems:
- too many at beginning of project
- below planned level during most of development
  - noting that productivity increased dramatically
- high turnover rate

Process compliance:
- stopped doing inspections
- allowed errors to leak to later phases

Requirements changes after Build 2 code and unit test

Conclusion:
- expect further cost and schedule growth due to low code production and increased number of functions to be implemented in Build 2

Possible Actions

Developer Actions

- replan based on current performance
- get staffing under control
  - verify the skills balance of resources
  - do not decrease staffing to conform to “planned” staffing, particularly if that would decrease the number of programmers
- restart inspections
  - code
  - test cases

Acquirer Decision Options

- use contract labor (additional costs)
- deliver smaller size - less functionality
- accept schedule slip

Focusing In

Earlier:
- trends, roles, models
- measurement methods
- evaluating deliverables

Key Points:
- use the Performance Analysis Model as a causal analysis navigation aid
- always use multiple indicators
- couple data analysis with knowledge of your and your contractor's processes

What's in sight:
- What would YOU include in the contract?
- How to communicate using your measures

Outline

Context
- state of the community
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Summary

Writing Your Contract

Performance-based contracting

- contractors are paid based on how they meet predefined metrics

General tips:

- Consider project, product, process measures
- Specify frequency of reporting
- Specify target performance where known
  - the “SMART” approach applies: specific, measurable, attainable, realistic, timely

Discussion: Write Your Contracts!

For the two-contract illustration just reviewed, what measures would YOU request in the contracts?

Which measures do you think would be readily available (or not)?

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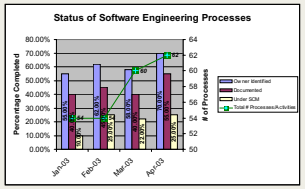
Summary

Goal: Establish Acquisition Processes

Success Criteria

Sr. Mgmt scorecard ; Middle Mgmt dashboard



Success Indicators

process owners, training, CM, and documentation (future: procedural adherence)

Strategy to accomplish goal

- Reference models: CMMI, SA CMM, IEEE/ISO 12207
- Leverage CMMI capabilities built in engineering: MA, REQM, RD, CAR
- Aim for CMMI capability in selected PAs: SAM, DAR, RSK, PP/PMC, CM, PPQA
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Middle Mgmt Dashboard

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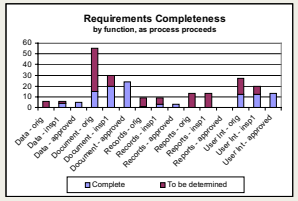
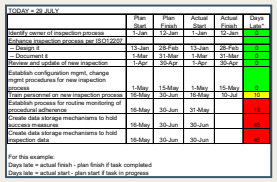


Analysis Indicators

Reqts completeness – original, at inspection, approved (for contract 1)

Tasks to Accomplish goal

- Implement requirements management process
- Tailor existing project monitoring processes for acquisition managers
- …..



Progress Indicators

start, finish dates with progress noted (move toward EV)

Illustration: Goal Structure

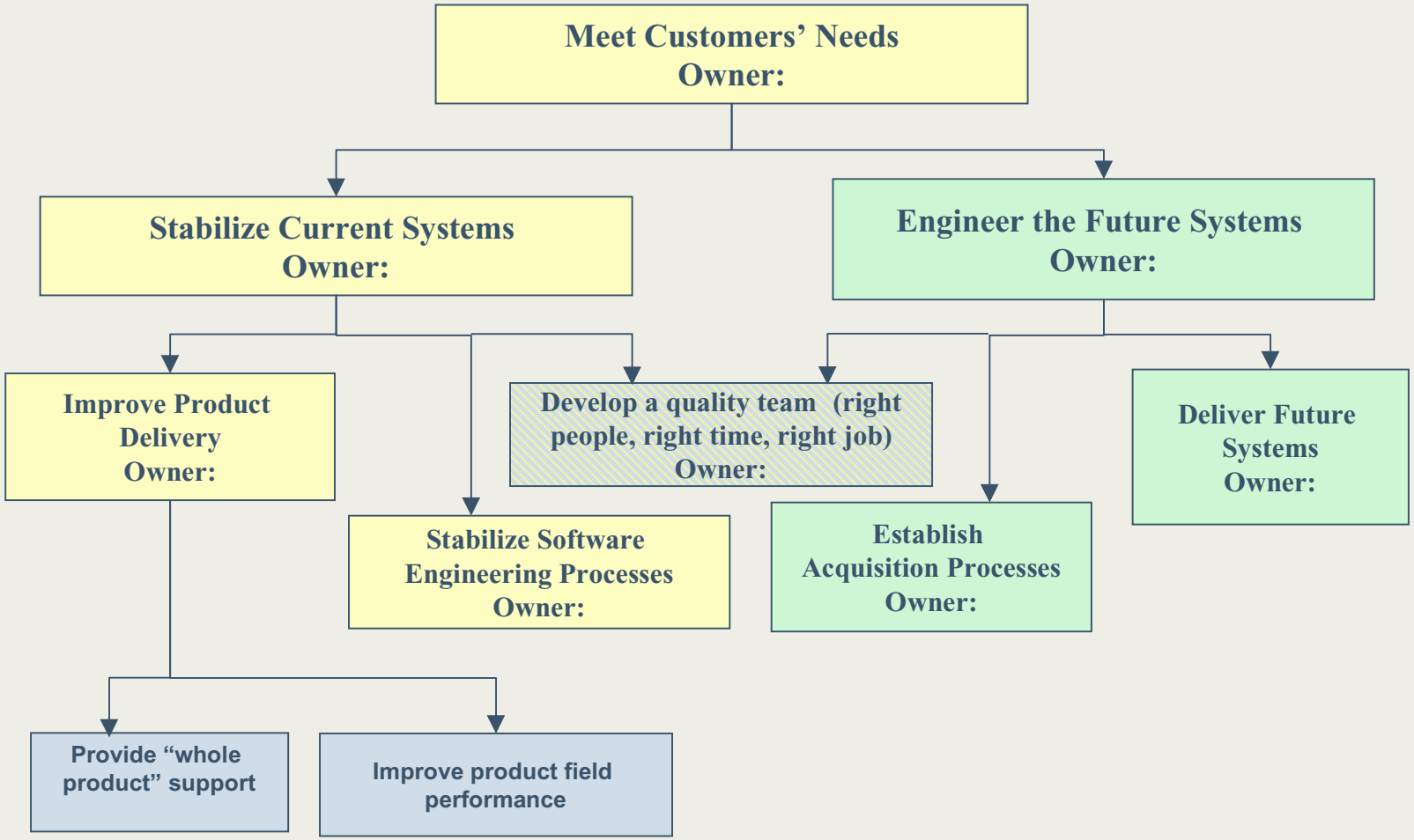
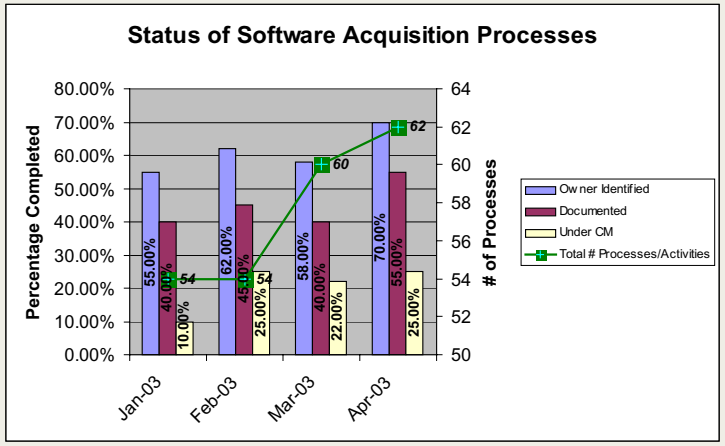
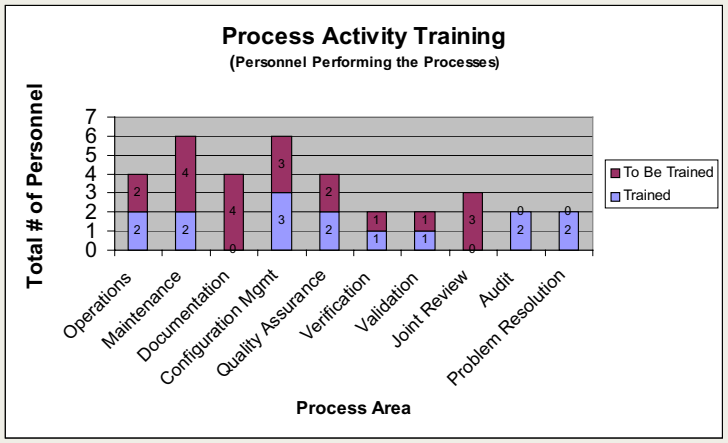


Illustration: Success Indicators Establish Acquisition Processes

Two key success indicators (excerpted from indicator templates)

- status of ownership, training, documentation, configuration management of processes (evolve into procedural adherence)
- status of training, using ISO12207 to group processes





After processes established, monitor sustainment or adherence

- use appraisal and/or audit results

Illustration: Senior Management Reporting

Required contractor metrics reported by all programs

- size growth
- workforce size and qualifications
- selected earned value (EV)
- quality trends
- requirements fulfillment

Required acquirer metrics reported by all programs

Outline

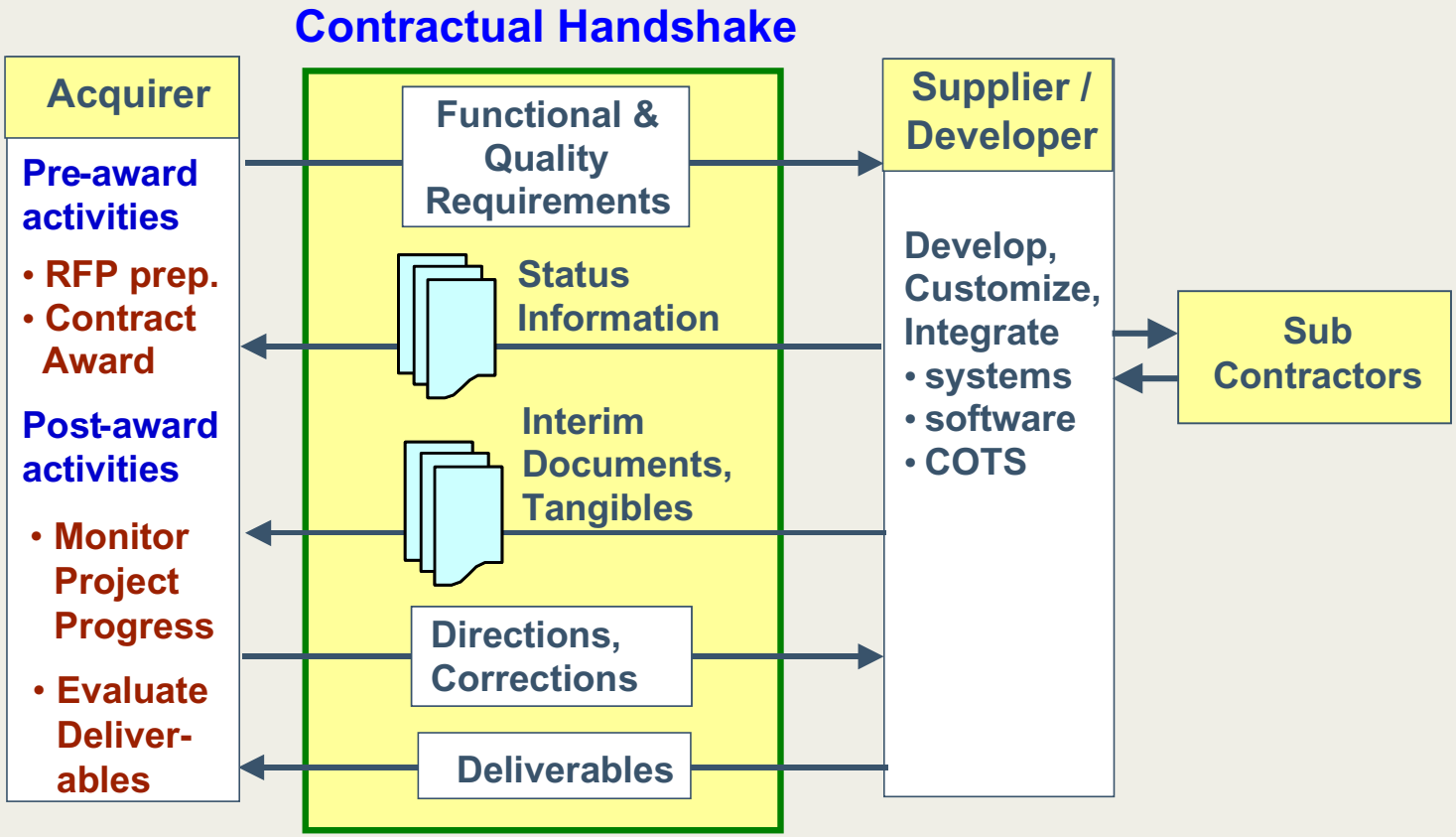
Context
- State of the community
- Changing Perspectives

Background
- Roles & Responsibilities
- Maturity Models
- Measurement & Analysis Methods

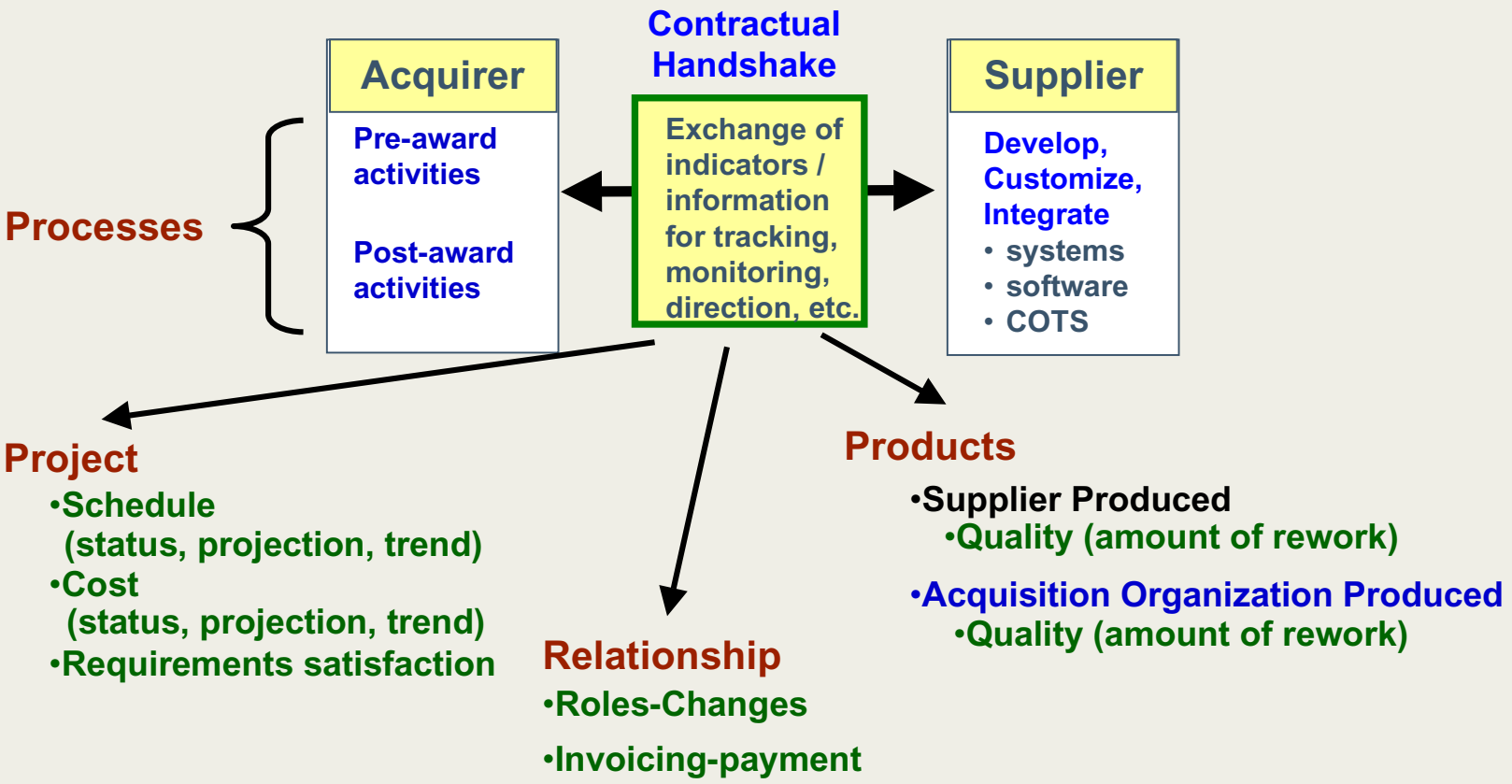
Scenario
- goal-setting and success, progress, analysis indicators
- inspecting the quality of deliverables: requirements
- monitoring and oversight: progress analysis
- measurement in the contract
- communicating with integrated measures

Summary

Roles and Information Exchange



Measuring Project, Product, Process



Summary – Focus Points

Key acquisition responsibilities (after contract award):

- monitoring and oversight
- inspecting, reviewing, and understanding documents and other work products

Post-contract award success depends on pre-contract award activities

- building measurement expectations into contracts
- establishing good partnerships and working relationships with contractors

Measure products, processes, projects, relationships

- requirements development, management, products should not be exempt! They are measurable.

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[ASSIP 03] Information from a 2003 Survey of Army Acquisition Program Managers

[Barbour 03] Taken from a set of workshop slides.

[C-M-H 03] Carleton, Anita, Robert Mishler and Watts Humphrey, The integrated Software Acquisition Measurement (ISAM) Project, Interim Status Report

[DAD 03] Siviy, Jeannine and William Florac, Data Analysis Dynamics, Half Day Tutorial Delivered at SEPG 2003, Boston, MA

[Diana 03] Diana, Alison, Outsourcing by the Numbers, http://www.ecommercetimes.com/perl/story/32114.html

[DZ 02] Zubrow, David, Putting 'M' in the Model: Measurement and Capability Maturity Model® Integration (CMMI℠), ICSQ, 29 October 2003, Ottawa, Canada

[DZ – P 03] Adapted from [DZ 02] by Mike Phillips for a client workshop

[Ferguson 03] Ferguson, Jack, Use of CMMI in an Acquisition Context, CMMI Users Group 2003, Denver, CO

[GQIM 96] Goal-Driven Software Measurement--A Guidebook http://www.sei.cmu.edu/publications/documents/96.reports/96.hb.002.html

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[PSM 00] Practical Software and Systems Measurement A Foundation for Objective Project Management, Guidebook, version 4.0b, Practical Software and Systems Measurement Support Center, U.S. TRACOM-ARDEC, AMSTA-AR-QA-A, Picatinny Arsenal, NJ, Website: www.psmsc.com, October 2000

[SWM 01] Software Magazine, Feb/March, 2001

Reading & Resources 1

Note: URLs valid as of tutorial delivery date.

Practical Software and Systems Measurement (PSM)

- reference for the Performance Analysis Model
- reference lists of measures to consider
- http://www.psmsc.com

Goal Driven Measurement (GDM) and
Goal-Question-Indicator-Metric (GQIM)

- front end for selecting most relevant PSM measures
- used for developing context-specific indicators, particularly "success indicators"
- "Goal-Driven Software Measurement--A Guidebook" http://www.sei.cmu.edu/publications/documents/96.reports/96.hb.002.html

Reading & Resources 2

Note: URLs valid as of tutorial delivery date.

Defense Acquisition University (DAU) Deskbook
- http://deskbook.dau.mil/jsp/default.jsp
- provides information about regulatory references, mandatory and discretionary references by service branch, and several knowledge repositories

Guidelines for Successful Acquisition and Management of Software-Intensive Systems,
http://www.stsc.hill.af.mil/resources/tech_docs/index.html

Acquisition Centers of Excellence
- Air Force, for instance ESC Hanscom
  - http://esc.hanscom.af.mil/ESC-BP/
- Navy
  - http://www.ace.navy.mil/public/html/

Reading & Resources 3

Note: URLs valid as of tutorial delivery date.

Project Management Body of Knowledge (PMBOK®)

- proven, traditional project management practices and innovated, advanced practices with more limited use
- Project Management Institute Guide to the PMBOK contains the generally accepted subset of knowledge and practices that are applicable to most projects most of the time
  - http://www.pmi.org/info/PP_StandardsExcerpts.asp
  - http://www.pmi.org/info/PP_PMBOK2000Excerpts.asp